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A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

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Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA*

Thesaurus should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Volume 10 Number 10 / May 23, 1972

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 1282
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 1287
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 1289
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 1297
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 1306
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 1308
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 1314
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 1317
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 1319
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 1321
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 1324
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 1330
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 1347
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 1355
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 1359
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 1362
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 1367
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 1371
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 1373
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1378
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 1380
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 1381
Includes acoustics, Cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

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Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

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Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 1390
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 1395
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

28 Propulsion Systems 1396
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 1398
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 1399
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1402
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1405
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 1409
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 1413
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

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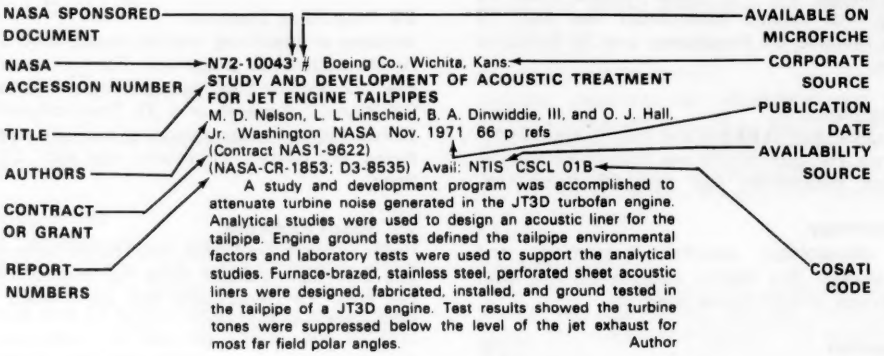
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N72-10043* # Boeing Co., Wichita, Kans.
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STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
TITLE
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
PUBLICATION DATE
(Contract NAS1-9622)
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(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B
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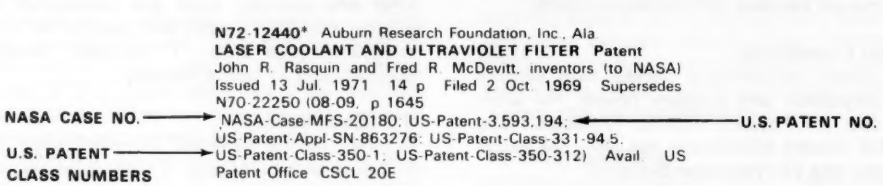
REPORT NUMBERS
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

PATENT CITATION


N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA)
Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
NASA CASE NO.
NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5;
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US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION

N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
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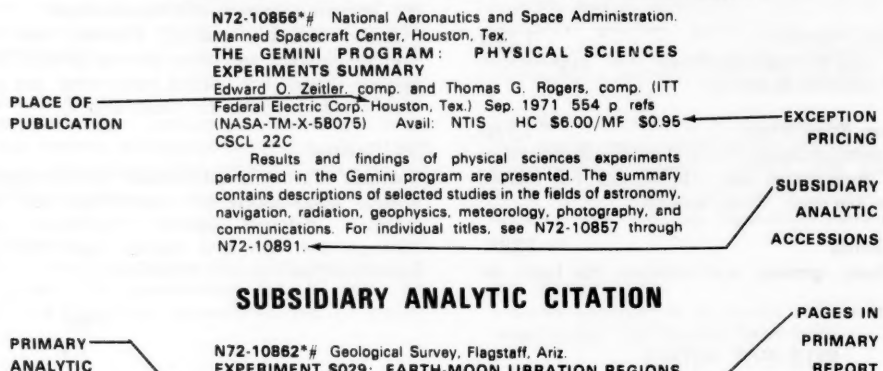
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Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.
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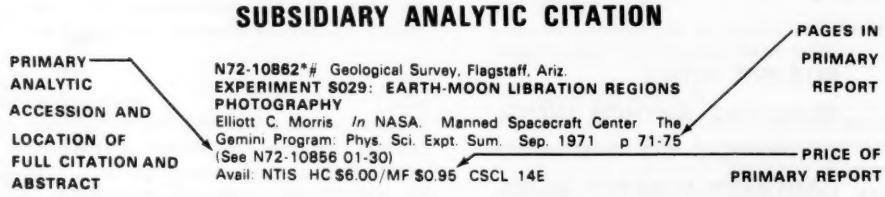
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Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-18993*+ National Aeronautics and Space Administration, Washington, D.C.

AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 13

Jan. 1972 91 p refs

(NASA-SP-7037(13)) Avail: NTIS CSCL 01A

This special bibliography lists 283 reports, articles, and other documents introduced into the NASA scientific and technical information system in December, 1971. Emphasis is placed on engineering and theoretical aspects for design, construction, evaluation, testing, operation and performance of aircraft (including aircraft engines), and associated components, equipment and systems. Also included are entries on research and development in aeronautics and aerodynamics and research and ground support for aeronautical vehicles. Author

N72-18994*# General Motors Corp., Indianapolis, Ind.

DESIGN AND EXPERIMENTAL RESULTS OF A HIGHLY LOADED, LOW SOLIDITY, JET FLAP ROTOR

James L. Bettner Washington NASA Mar. 1972 117 p refs

(Contract NAS3-12424)

(NASA-CR-1968; EDR-7045) Avail: NTIS CSCL 01A

The overall performance of a single-stage turbine with a low solidity jet flap rotor blade assembly was tested over a range of cavity pressure ratios, equivalent speeds, and expansion ratios. The rotor blades were designed with negative hub reaction and a mean-line axial chord solidity of 0.922. The results of the investigation are compared with the performance of a modified jet flap rotor blade which was designed to similar velocity diagrams but with a mean-section, axial chord solidity of 1.541. Both rotors were tested with the same stator. Author

N72-18995*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECT OF LIMITED AMPLITUDE AND RATE OF FLAP MOTION ON VANE-CONTROLLED GUST ALLEVIATION SYSTEM

L. Keith Barker, Daniel J. Crawford, and Gene W. Sparrow Washington Mar. 1972 43 p refs

(NASA-TN-D-6733; L-8027) Avail: NTIS CSCL 01A

An airplane (light transport type) is assumed to be in level flight (no pitching) through atmospheric turbulence which has a mean-square vertical gust intensity of 9.3 (m/sec)sq. The power spectral density of the vertical acceleration due to gusts is examined with and without a gust-alleviation system in operation. The gust-alleviation system consisted of wing flaps that were used in conjunction with a vane mounted ahead of the airplane to sense the vertical gust velocity. The primary purpose of this study was to examine the change in the effectiveness of the gust-alleviation system when the flap motion is limited in amplitude and rate. The alleviation system was very effective if no restrictions were placed on flap motion (rate and amplitude). Restricting the flap amplitude to 0.5 radian did not appreciably change the effectiveness. However, restricting the flap rate did reduce the gust alleviation, and restricting the flap rate to 0.25 rad/sec actually caused the alleviation system to increase the vertical acceleration above that for the no-alleviation situation. Based upon this analysis, rate limiting appears to be rather significant in gust-alleviation systems designed for passenger comfort. Author

N72-18996*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

FLIGHT-DETERMINED CHARACTERISTICS OF AN AIR INTAKE SYSTEM ON AN F-111A AIRPLANE

Donald L. Hughes and Harold J. Johnson Washington Mar. 1972 66 p refs

(NASA-TN-D-6679; H-661) Avail: NTIS CSCL 01B

Flow phenomena of the F-111A air intake system were investigated over a large range of Mach number, altitude, and angle of attack. Boundary-layer variations are shown for the fuselage splitter plate and inlet entrance stations. Inlet performance is shown in terms of pressure recovery, airflow, mass-flow ratio, turbulence factor, distortion factor, and power spectral density. The fuselage boundary layer was found to be not completely removed from the upper portion of the splitter plate at all Mach numbers investigated. Inlet boundary-layer ingestion started at approximately Mach 1.6 near the translating spike and cone. Pressure-recovery distribution at the compressor face showed increasing distortion with increasing angle of attack and increasing Mach number. The time-averaged distortion-factor value approached 1300, which is near the distortion tolerance of the engine at Mach numbers above 2.1. Author

N72-18997*# Scientific Translation Service, Santa Barbara, Calif.

TRANSONIC TESTING OF THE ENGINE NACELLE AIR INTAKE AND AFTERBODY

J. Leynaert Washington NASA Mar. 1972 22 p Transl. into ENGLISH of "Entree d'air et arriere-corps de fuseau-moteur en transsonique", Rept. ONERA-TP-943, ONERA, Chantillon, France, 1971 p 1-11

(Contract NASw-2035)

(NASA-TT-F-14154; ONERA-TP-943) Avail: NTIS CSCL 01A

An example is presented of the study of a double-flux engine nacelle at high subsonic Mach numbers. The investigation was carried out at high Reynolds numbers with two separate

models for the air intake and the afterbody. The test on the afterbody shows that the conditions of variable jets do not significantly affect the upstream flow around the nacelle intake and cowl, except for the immediate vicinity of the exhaust. This fact justifies the large scale study of the air intake with a model supported downstream by a cylindrical tube replacing the jet. In the same way, mass flow rate variations of the air intake do not influence the flow around the afterbody, within given limits. This makes it possible to study the afterbody on an upstream sting. The significance and limitations of these studies are discussed in terms of the test results. Author

N72-18998*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF 1380-FOOT-PER-SECOND TIP-SPEED AXIAL-FLOW COMPRESSOR ROTOR WITH BLADE TIP SOLIDITY OF 1.1
David C. Janetzke, Calvin L. Ball, and Roy D. Hager Washington Mar. 1972 90 p refs
(NASA-TM-X-2449; E-6686) Avail: NTIS CSCL 20D

The aerodynamic design parameters are presented along with the overall and blade element performance, of an axial-flow compressor rotor designed to study the effects of blade solidity on efficiency and stall margin. At design speed the peak efficiency was 0.853 and occurred at an equivalent weight flow of 65.7lb/sec. The total pressure ratio was 1.68. Design efficiency, weight flow, pressure ratio, and temperature ratio were 0.822, 65.3, 1.65, and 1.187, respectively. Stall margin for design speed was 14 percent based on the weight flows and pressure ratios at peak efficiency and just prior to stall. Author

N72-18999# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
RESULTS OBTAINED BY APPLYING THE KERNEL FUNCTION METHOD TO LINEARIZED SUPERSONIC LIFTING SURFACE THEORY UPON VARIATION OF INPUT PARAMETERS FOR VARIOUS PLATFORMS
A. J. L. R. Hasekamp 14 Dec. 1971 108 p refs
(X-28-445) Avail: NTIS

Results are presented from a program based on the kernel function method in linearized oscillating supersonic lifting surface theory. Computed generalized aerodynamic force coefficients are compared with corresponding quantities from several sources of literature. For a number of cases dimensionless pressure difference plots are given over lines of the planform under consideration. In the same picture, these plots can be compared with plots from programs based on analytical methods. Author

N72-19000*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
WIND-TUNNEL SIMULATION OF STORE JETTISON WITH THE AID OF MAGNETIC ARTIFICIAL GRAVITY
Timothy Stephens and Ronald Adams Washington NASA Feb. 1972 154 p refs
(Contract NAS1-9812)
(NASA-CR-1955; TR-174) Avail: NTIS CSCL 01A

A method employed in the simulation of jettison of stores from aircraft involving small scale wind-tunnel drop tests from a model of the parent aircraft is described. Proper scaling of such experiments generally dictates that the gravitational acceleration should ideally be a test variable. A method of introducing a controllable artificial component of gravity by magnetic means has been proposed. The use of a magnetic artificial gravity facility based upon this idea, in conjunction with small scale wind-tunnel drop tests, would improve the accuracy of simulation. A review of the scaling laws as they apply to the design of such a facility is presented. The design constraints involved in the integration of such a facility with a wind tunnel are defined. A detailed performance analysis procedure applicable to such a facility is developed. A practical magnet configuration is defined which is capable of controlling the strength and orientation of the magnetic artificial gravity field in the vertical plane, thereby allowing simulation of store jettison from a diving or climbing aircraft. The factors involved in the choice between continuous or intermittent operation of the facility, and the use of normal or superconducting magnets, are defined. Author

N72-19001*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A WIND-TUNNEL EVALUATION OF ANALYTICAL TECHNIQUES FOR PREDICTING STATIC STABILITY AND CONTROL CHARACTERISTICS OF FLEXIBLE AIRCRAFT
Irving Abel Washington Mar. 1972 70 p refs
(NASA-TN-D-6656; L-8105) Avail: NTIS CSCL 01A

An experimental evaluation of analytical techniques for predicting certain stability and control characteristics of a large flexible aircraft is presented. Analytical methods based on both the model approach and flexibility influence coefficients are developed to predict the aerodynamic characteristics of a flexible airplane. These methods are then applied to a flexibly scaled model of a supersonic transport configuration. Comparisons of wind-tunnel data, calculations based on the model approach, and flexibility influence coefficients are presented over the Mach number range from 0.6 to 2.7. An examination of the results obtained from this study indicates that both analytical techniques predict reasonably well the effect of flexibility on the basic longitudinal characteristics and that both techniques give generally comparable results. Author

N72-19002*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL CORRELATION OF CENTRIFUGAL COMPRESSOR DESIGN GEOMETRY FOR MAXIMUM EFFICIENCY WITH SPECIFIC SPEED
Michael R. Galvas Washington Mar. 1972 39 p refs
(NASA-TN-D-6729; E-6638) Avail: NTIS CSCL 21E

Centrifugal compressor performance was examined analytically to determine optimum geometry for various applications as characterized by specific speed. Seven specific losses were calculated for various combinations of inlet tip-exit diameter ratio, inlet hub-tip diameter ratio, blade exit backsweep, and inlet-tip absolute tangential velocity for solid body prewhirl. The losses considered were inlet guide vane loss, blade loading loss, skin friction loss, recirculation loss, disk friction loss, vaneless diffuser loss, and vaned diffuser loss. Maximum total efficiencies ranged from 0.497 to 0.868 for a specific speed range of 0.257 to 1.346. Curves of rotor exit absolute flow angle, inlet tip-exit diameter ratio, inlet hub-tip diameter ratio, head coefficient and blade exit backsweep are presented over a range of specific speeds for various inducer tip speeds to permit rapid selection of optimum compressor size and shape for a variety of applications. Author

N72-19003# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF TURBULENT SUPERSONIC SEPARATED FLOWS OVER FRONT STEPS
H. T. Uebelhack 1971 69 p refs Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

Pressure measurements in the separated region ahead of front steps in supersonic turbulent flow were carried out on two-dimensional and axisymmetric internal and external flow models. Parameters were Mach number, Reynolds number and relative step height. In the theoretical analysis of the separated flow field a flow model was defined consisting of four separately treated regions: the separation region, the free shear layer, the reattachment region, and the reverse flow region. Korst's turbulent jet mixing theory was utilized to treat the free shear layer. The initial disturbance in the development of the free shear layer was treated by the mass bleed concept. The reattachment pressure at the outer corner of the step could be determined within a flow percent. The drag of the step is predicted in the present analysis with very good accuracy. Author (ESRO)

N72-19004# Bochum Univ. (West Germany). Inst. for Thermo-and Fluid Dynamics.
INVESTIGATIONS OF THE ROLLING DAMPING OF SLENDER WINGS [UNTERSUCHUNGEN DER ROLLDAEMPFUNG VON SCHLANKEN FLUEGELN]
F. Schlottmann Cologne DGLR 1971 20 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger. 11-13 Oct. 1971
Avail: NTIS

The aerodynamic forces acting upon slender wing configurations in roll were measured in a low speed wind tunnel in order to determine the influence of variation of angle of attack and roll angular velocity. It was shown, for the delta and square wing models investigated, that a nonlinear relationship exists between rolling moment and roll angular velocity, and relationship between roll damping and angle of attack. The reason for this is the presence of the leading edge separation together with the formation of rolled up vortices over the wing plane. The different vortex configurations and the resulting effects on roll damping are discussed, and compared with the theory. ESRO

N72-19005# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
REFLECTIONS OF REGULAR AND SINGULAR SHOCK WAVES: APPLICATION TO INTAKES AND TO THE MACH DISC PROBLEM
Pierre Diringer 1971 58 p refs In FRENCH; ENGLISH summary
(ONERA-NT-183) Avail: NTIS

The reflection of shock waves within two-dimensional or axisymmetric inlets at supersonic speeds is computed using the method of characteristics. The singular reflection of shock waves on the axis of axisymmetric flow encountered in jet flows is calculated. The flow behind Mach disc is treated both by integral and one-dimensional flow methods. Complete calculations of the hypersonic flow in the sonic throat and in the second Mach disc are presented. The positions of shock waves, slip line, and boundary in subcritical jets are computed and confirmed by experimental results. ESRO

N72-19006# Salford Univ. (England).
THE EFFECT OF CONICAL THICKNESS DISTRIBUTIONS ON THE SEPARATED FLOW PAST SLENDER DELTA WINGS
H. Portnoy and S. C. Russell (Crane Ltd., Stockport, Engl.) London Aeron. Res. Council 1971 27 p refs Supersedes ARC-32834
(ARC-CP-1189) Avail: NTIS; HMSO: 48.5p; PHI: $2.15

A method is described for calculating the effects of small conical distributions on the flow past slender delta wings with leading-edge separation. Comparisons with limited experimental results indicate that, despite the basic inaccuracies of the model, some of the thickness effects are predicted. Author (ESRO)

N72-19007# Royal Aircraft Establishment, Farnborough (England). Aerodynamic Dept.
FREE-FLIGHT MEASUREMENTS OF PRESSURE AND HEAT TRANSFER ON A BLUNT LEADING-EDGE CARET WING AT DESIGN AND OFF-DESIGN MACH NUMBERS (MACH SUB INFINITY EQUALS 0.9 TO 3.36)
G. H. Greenwood London Aeron. Res. Council 1971 46 p refs Supersedes RAE-TR-70129; ARC-32593
(ARC-R/M-3679; RAE-TR-70129; ARC-32593) Avail: NTIS; HMSO: £1.61; PHI: $6.25

Pressure and heat-transfer measurements were made in free flight on a caret wing with blunt leading edges and nose, at speeds below and above the design Mach number of 2.47. Comparison with data from a corresponding caret wing, but with sharp leading edges, indicates that the effect of blunting is confined to a region about 2 to 3 leading-edge diameters from the leading edge. At M sub infinity greater than 1.5 the data for the blunt leading edges and for the plane lifting surfaces were predicted with reasonable accuracy using easily-applied existing theory. A considerable reduction in heating rate was found in the wing junction. Author (ESRO)

N72-19008# Technische Hogeschool, Delft (Netherlands).
A METHOD TO DERIVE ANGLE OF PITCH, FLIGHT-PATH ANGLE AND ANGLE OF ATTACK FROM MEASUREMENTS IN NONSTEADY FLIGHT
R. J. A. W. Hosman Apr. 1971 107 p refs
(VTH-156) Avail: NTIS

A method is described to determine the angle of pitch, the flight-path angle and the angle of attack of an aircraft during steady or nonsteady flight. These angles are determined by integration of the rate of pitch and the specific forces, and not by directly measuring these angles. Errors in the estimates of the initial conditions of the integrations and of the zero shifts in the measurements are corrected by comparing the computed and the measured values of the change in altitude and airspeed. An error analysis is carried out, to determine the accuracy with which the angles of pitch, flight path, and attack are determined by the described method for steady as well as for nonsteady flight. Author (ESRO)

N72-19009# Technische Hogeschool, Delft (Netherlands).
THE DETERMINATION OF STABILITY DERIVATIVES AND PERFORMANCE CHARACTERISTICS FROM DYNAMIC MANOEUVRES
O. H. Gerlach Mar. 1971 44 p refs Presented at the 38th Meeting of the AGARD Flight Mech. Panel, Toulouse, 10-13 May 1971
(VTH-163) Avail: NTIS

Three frequency ranges of interest to the flight dynamicist are distinguished: (1) the low-frequency or phugoid and spiral mode frequency range; (2) the intermediate or short-period and Dutch roll frequency range; and (3) the high-frequency or elastic modes frequency range. Flight tests to determine derivatives in the combined low and intermediate frequencies are described and the importance of accurate measurements and of an adequate frequency content of the input signal in the tests is stressed. The rationale behind the choice of the shape of the input signal used is given. The application of the derivatives, not only for stability and control purposes, but also for the determination of performance characteristics, is discussed.
Author (ESRO)

N72-19010# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW RESEARCHES ON SMALL SPAN-CHORD RATIO WINGS WITH LATERAL JETS
E. Carafoli and N. Camarasescu 22 Oct. 1971 21 p refs Transl. into ENGLISH from Acad. Rep. Populare Romine, Studii Cercetari Mecan. Apl. (Bucharest), v. 29, no. 4, 1970 p 947-962
(AF Proj. 7343)
(AD-733858; FTD-HC-23-319-71) Avail: NTIS CSCL 01/1

The article deals with the lift increase of small span-chord ratio wings with lateral fluid jets in the plane of the wings, directed along the span. Some theoretical considerations as well as the experimental results obtained in the wind tunnel for a series of wings with different span-chord ratios are presented.
GRA

N72-19011# Army Foreign Science and Technology Center, Charlottesville, Va.
AERODYNAMIC CALCULATION FOR HELICOPTER LIFTING ROTORS IN VERTICAL DESCENT (VORTEX RING METHOD)
V. I. Shaidakov Oct. 1971 18 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviat. Tekhn. (USSR), v. 10, no. 1, 1967 p 29-36
(AD-734229; FSTC-HT-23-708-71) Avail: NTIS CSCL 01/1

A theoretical study was made of the performance of a lifting helicopter rotor during vertical descent. The vortex ring

method was used in aerodynamic calculation of lifting systems.
Author (GRA)

N72-19012# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
SOME RECENT RESEARCH ON AIRFOIL DYNAMIC STALL WITH APPLICATION TO AIRFOIL DESIGN
Norman D. Ham Sep. 1971 30 p refs
(Contract N00019-70-C-0223)
(AD-734699; ASRL-TR-165-1) Avail: NTIS CSCL 01/3

Some recent research on airfoil dynamic stall tentatively defines the boundary-layer flow processes during dynamic stall and suggests an approach to airfoil design for stall delay. The effect of changes of airfoil leading-edge radius and camber on increments in maximum lift coefficients is estimated, using a simple criterion for leading-edge stall. Author (GRA)

N72-19013# Army Foreign Science and Technology Center, Charlottesville, Va.
APPLICATION OF THE RING VORTEX METHOD TO AERODYNAMIC DESIGN OF LIFTING ROTOR SYSTEMS
V. I. Shaydakov 10 Nov. 1971 14 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), no. 3, 1966
(AD-735018; FSTC-HT-23-709-71) Avail: NTIS CSCL 01/3

The operation of the lifting rotor during flight with a horizontal velocity component has been the subject of considerable study. The ring vortex method is a simplified procedure for accurately determining the aerodynamic characteristics of the lifting rotor. The replacement of the vortex cylinder with a system of discrete vortex rings is equivalent to expansion of the vortex cylinder into rings and longitudinal vortices. Ignoring the longitudinal vortices is equivalent to ignoring the closure of the stream behind the rotor. For low loaded lifting rotors, no significant error is thus created. GRA

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-19014*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIR CUSHION VEHICLES: A BRIEFING
John L. Anderson and Patrick M. Finnegan Oct. 1971 56 p refs
(NASA-CR-125686) Avail: NTIS CSCL 01B

Experience and characteristics; the powering, uses, and implications of large air cushion vehicles (ACV); and the conceptual design and operation of a nuclear powered ACV freighter and supporting facilities are described. Author

N72-19015# Federal Aviation Administration, Washington, D.C. Avionics Branch.
EFFECTIVE AVIONICS MAINTENANCE
Robert A. Cole 1971 12 p Presented at the 7th Ann. FAA Intern, Aviation Maintenance Symp., Okla. City, 7-9 Dec. 1971
Avail: NTIS

Avionics maintenance is discussed in terms of aviation safety. The operational factors that work against aviation safety are reviewed, and the avionic systems that enable aircraft to operate safely include communication, navigation, identification, and control. Four points are emphasized: (1) Avionic systems are becoming increasingly important to the operational safety of modern aircraft. (2) Flight safety can be improved through effective avionic maintenance. (3) Mandatory requirements for periodic maintenance will not be necessary if avionic maintenance is made effective by early detection and correction of malfunctions. (4) Training, test equipment, self-test, and built in test equipment can aid in making avionic maintenance more effective. F.O.S.

N72-19016# Federal Aviation Administration, Washington, D.C.
THE ALTIMETER CREDIBILITY GAP
Hugh R. Skinner, Jr. 1971 72 p Presented at the 7th Ann. FAA Intern. Aviation Maintenance Symp., Okla. City, 7-9 Dec. 1971
Avail: NTIS

Altimeter errors and their causes are discussed. The sources of altimeter errors include mechanical limitations of the instrument, operation and installation errors, the use of the standard atmosphere for conversion of pressure into height indications, and human error in reading the instrument. It is concluded that many errors of the system are inherent and cannot be reduced. However if extra effort is made by the user to reduce error factors over which he has control, the overall accuracy will be improved. F.O.S.

N72-19017# University of Southern Calif., Los Angeles. Inst. of Aerospace Safety and Management.
ANALYTICAL TECHNIQUES FOR EFFECTIVE MAINTENANCE
David S. Hall and Eugene L. Holt 1971 14 p refs Presented at 7th Ann. Intern. Aviation Maintenance Symp., Oklahoma City, 7-9 Dec. 1971
Avail: NTIS

Systems analysis techniques are applied to aircraft maintenance to achieve aviation safety. The failure mode analysis method is discussed along with the fault tree analysis method. It is concluded: (1) The maintenance manager needs to know how to make decisions and that these decisions affect the safety and efficiency of his operation. (2) Many of these decisions can be made in advance when time or other pressure is not a factor. (3) Greater knowledge of the implications of a decision is available to the individual who approaches each problem systematically. (4) Systematic and analytical decision making is within the capability of today's maintenance activity. F.O.S.

N72-19018# Douglas Aircraft Co., Inc., Santa Monica, Calif. Structural Mechanics Subdiv.
DEVELOPING THE DC-10 STRUCTURAL INSPECTION PROGRAM
M. E. Stone and H. F. Heap Dec. 1971 60 p refs Presented at the 7th Ann. FAA Intern. Aviation Maintenance Symp., Okla. City, 7-9 Dec. 1971 Prepared in cooperation with United Air Lines, Inc., Chicago, Ill.
Avail: NTIS

An inspection and maintenance program for the DC-10 structures is discussed. Factors that must be considered in developing an inspection program are fatigue, crack propagation, residual strength, preload, and corrosion. An evaluation of a statistical approach to structural inspection program design is included. F.O.S.

N72-19019*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC PARAMETERS OF THE NAVION AIRPLANE EXTRACTED FROM FLIGHT
William T. Suit Washington Mar. 1972 62 p refs
(NASA-TN-D-6643; L-7910) Avail: NTIS CSCL 01A

An iterative method, which is characterized as a maximum-likelihood minimum-variance technique, was used to extract the aerodynamic parameters of a Navion airplane from flight data. The purposes were to compare the results with parameters obtained from wind-tunnel tests and with results obtained by analog matching the same data, and to develop

techniques for application of the parameter extraction program. Results from the study showed that the parameter-extraction program can produce aerodynamic parameters which will permit close estimation of the aircraft time histories used in the extraction process. The program determined an estimate of the standard deviations of the states and parameters. These estimates were used to indicate how well the calculated states fit the flight data and the confidence in the values of the estimated parameters. The study also showed that the values of the parameters were affected by the data and mathematical model used during the extraction process. Because of the lack of confidence in the parameters extracted by use of some of the sets of data, several parameters were estimated by other methods. By using a combination of methods, a set of parameters which gave a fit to the data was obtained. Author

N72-19020# Federal Aviation Administration, Washington, D.C. Aeromedical Applications Div.

THE PSYCHOSOCIAL RECONSTRUCTION INVENTORY: A POSTDICTAL INSTRUMENT IN AIRCRAFT ACCIDENT INVESTIGATION

Robert E. Yanowitch, Stanley R. Mohler, and E. A. Nichols Jan. 1972 7 p refs

(FAA-AM-72-2) Avail: NTIS

A new approach to the investigation of aviation accidents has recently been initiated, utilizing a follow-on to the psychological autopsy. This approach, the psychosocial reconstruction inventory, enables the development of a dynamic, retrospective portrait of the pilot-in-command subsequent to an accident. Twelve fatal general aviation accidents were studied in this way in 1971. When routine accident investigation data are supplemented by a psychosocial or lifestyle reconstruction, a much deeper understanding of the cause of the accident often emerges. By increasing pilot insight into the role of emotions and situational stress in accident causation, more effective accident prevention programs result. Author

N72-19021*# Boeing Co., Seattle, Wash.

STUDY OF AIRCRAFT IN INTRAURBAN TRANSPORTATION SYSTEMS, SAN FRANCISCO BAY AREA

Washington NASA Mar. 1972 72 p refs

(Contract NAS2-5969)

(NASA-CR-2006) Avail: NTIS CSCL 01B

The nine-county San Francisco Bay area is examined in two time periods (1975-1980 and 1985-1990) as a scenario for analyzing the characteristics of an intraurban, commuter-oriented aircraft transportation system. Aircraft have dominated the long-haul passenger market for some time, but efforts to penetrate the very-short-haul intraurban market have met with only token success. Yet, the characteristics of an aircraft transportation system, speed and flexibility, are very much needed to solve the transportation ills of our major urban areas. The aircraft intraurban system is a technically feasible alternative to ground transportation systems. Although requiring some subsidy, it becomes socially viable where substantial commuter traffic exists at ranges of 10 to 15 mi or more and where topographic features constrain ground travel. The general problem areas of community noise, air traffic congestion, ground transportation interface, pollution, and safety appear to have workable solutions. Author

N72-19022*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

LOW-LIFT-TO-DRAG-RATIO APPROACH AND LANDING STUDIES USING A CV-990 AIRPLANE

Berwin M. Kock, Fitzhugh L. Fulton, and Fred J. Drinkwater, III Washington Mar. 1972 45 p refs

(NASA-TN-D-6732; H-672) Avail: NTIS CSCL 01B

The results are presented of a flight-test program utilizing a CV-990 airplane, flow in low-lift-to-drag-ratio (L/D) configurations, to simulate terminal area operation, approach, and landing of large unpowered vehicles. The results indicate that unpowered approaches and landings are practical with vehicles of the size and performance characteristics of the proposed shuttle vehicle. Low L/D landings provided touchdown dispersion patterns acceptable for operation on runways of reasonable length. The dispersion pattern was reduced when guidance was used during the final approach. High levels of pilot proficiency were not required for acceptable performance. Author

N72-19023*# Scientific Translation Service, Santa Barbara, Calif.

EVALUATION OF TAKEOFF AND LANDING PERFORMANCE OF COMMERCIAL STOL AIRPLANES

M. Calcara Washington NASA Mar. 1972 33 p refs Transl. into ENGLISH from Aerotec. Missili Spazio (Milan), Apr.-Jun. 1971 p 113-125

(Contract NASw-2035)

(NASA-TT-F-14166) Avail: NTIS CSCL 01C

The basic requirements for commercial STOL airplanes leading to the use of high by-pass ratio turbofans and very advanced high-lift systems are briefly reviewed. With the method developed, a rapid evaluation of takeoff and landing performance may be made which permits an easy comparison of different configurations. The method takes into account: safety requirements (speed maneuvering margin, critical engine failure at takeoff, landing field length factor), passenger comfort and pilot limitations due to human factors (maximum rate of descent near the ground and reaction times). A numerical example illustrates the use of simple graphs, which are based on the more important project parameters. Author

N72-19024# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

PRESSURE MEASUREMENTS ON HARMONICALLY OSCILLATING WING TAILPLANE CONFIGURATIONS

H. Triebstein and J. Wagener Aug. 1971 71 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-54; AVA-FB-7118) Avail: NTIS

The results of pressure measurements on harmonically oscillating wing-tailplane configurations in the incompressible speed range are presented. The model consists of a variable sweep wing and a horizontal stabilizer. Special emphasis is given to the unsteady aerodynamic interfering effects at various wing-tailplane configurations. In particular, the effects of the wing sweep-back, the wing angle of attack and the V-position of the tailplane stabilizer are investigated in detail for several reduced frequencies and longitudinal positions of the wing and tailplane. Author

N72-19025*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NOISE PRODUCED BY A SMALL-SCALE, EXTERNALLY BLOWN FLAP

William A. Olsen, Robert G. Dorsch, and Jeffrey H. Miles Washington Mar. 1972 39 p refs

(NASA-TN-D-6636; E-6662) Avail: NTIS CSCL 01B

Noise data were obtained with a model of an externally blown flap of the type that is currently being considered for STOL aircraft. The noise caused by impingement of the jet on the flap is much louder than the nozzle jet noise. It is especially so directly below the wing. The noise level increases as the jet velocity and flap angle are increased. The sound power level increased with the sixth power of velocity. Several physical variations to the STOL model configuration were also tested. Two such variations, a large board and a slotless curved plate wing, had the same power spectra density (Strouhal number curve) as the model. Author

N72-19026*# Southampton Univ. (England). Inst. of Sound and Vibration Research.

HELICOPTER NOISE: BLADE SLAP. PART 2: EXPERIMENTAL RESULTS

John W. Leverton Washington NASA Mar. 1972 71 p refs

(Grant NGR-52-025-002)

(NASA-CR-1983) Avail: NTIS CSCL 01B

Blade slap encountered in rotary wings and its effect on helicopter performance are reported. The results of various individual flight tests are presented and, where possible, correlated with one another. Observations from the subjective evaluation of blade slap are included, together with a modified form of the blade slap factor (BSF) which can be used as a design criteria.
Author

N72-19027*# National Aeronautics and Space Administration, Washington, D.C.
FLIGHT RESEARCH CENTER, EDWARDS, CALIFORNIA. FINAL ENVIRONMENTAL IMPACT STATEMENT
18 Aug. 1971 12 p
(PB-202054-F; NASA-TM-X-67617) Avail: NTIS CSCL 14B

This is an institutional environmental impact statement relating to the overall operation of the NASA, Flight Research Center. The Center is located in Kern County, California, approximately 100 miles northeast of Los Angeles. Flight activities relate primarily to areas in the vicinity of Los Angeles, Kern, Inyo and San Bernardino counties in Southern California; and to areas in Southern Nevada (principally Nye and Clark counties. Operations of the Flight Research Center have a very negligible impact on the environment; and they are planned and controlled to eliminate or minimize effects on water, air and noise.
Author (GRA)

N72-19028# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: DOWNEAST AIRLINES SCHEDULED AIR TAXI PIPER PA-31, N595DE, AUGUSTA STATE AIRPORT, AUGUSTA, MAINE, 19 AUGUST 1971
19 Sep. 1971 20 p
(NTSB-AAR-72-6) Avail: NTIS

On August 19, 1971, a scheduled air taxi flight, utilizing a Piper PA-31, crashed about 4 miles short of Augusta State Airport, Augusta, Maine, while attempting an approach. The approach was being made in instrument conditions. Augusta State Airport is served by a VOR with DME capabilities requiring a nonprecision VOR appraoch. The weather conditions were above minimums but required an instrument approach. The pilot and two passengers were fatally injured, two passengers received serious injuries and three passengers received minor injuries. The probable cause of this accident was the improper action of the pilot in discontinuing the execution of a nonprecision instrument approach and attempting to maintain visual flight while operating in instrument flight conditions at an altitude below the level of obstructing terrain.
Author

N72-19029*# Aeronautical Research Associates of Princeton, Inc., N.J.
CROSS-SPECTRAL FUNCTIONS BASED ON VON KARMAN'S SPECTRAL EQUATION
John C. Houbolt and Asim Sen Washington NASA Mar. 1972
19 p refs
(Contract NAS1-9200)
(NASA-CR-2011; Rept-159) Avail: NTIS CSCL 01B

Cross-spectral functions for the vertical and longitudinal components of turbulence of a two-dimensional gust field are derived from the point correlation function for turbulence due to von Karman. Closed form solutions in terms of Bessel functions of order 5/6 and 11/6 are found. An asymptotic expression for large values of the frequency argument, and series results for small values of frequency, are also given. These results now form the base for studying the effect of spanwise variations in turbulence for a turbulence environment which is characterized by the von Karman isotropic spectral relations. Previous studies were based mainly on the Dryden-type spectral representation.
Author

N72-19030# Motoren-Und Turbinen-Union Muenchen G.m.b.H. (West Germany).
ENVIRONMENTAL EFFECTS OF TURBOJET ENGINES [DIE UMWELTWIRKUNGEN VON TURBOFLUGTRIEBWERKEN]
N. K. H. Scholz 1971 37 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

A survey is presented of environmental pollution produced by turbojet aircraft engines. The environmental effects are treated systematically and are subdivided into thermal, noise, and air pollution. Comparisons are made with other known pollutants. It is shown that noise generation is the hardest problem in turbine engine construction. Noise reduction is technically feasible, but at the expense of power, weight, volume, and costs. Cooperation between aircraft industry and basic research is found to be necessary.
ESRO

N72-19031# Max-Planck-Institut fuer Stromungsforschung, Gottingen (West Germany).
ANNOYANCE OF THE SURROUNDINGS CAUSED BY JET AIRCRAFT TRAFFIC NOISE [LAERMBELAESTIGUNG DER UMWELT DURCH DEN STRAHLFLUGVERKEHR]
G. Zimmermann Cologne DGLR 1971 27 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

A survey is presented of commercial jet aircraft noise problems, and possible ways to minimize these, in the vicinity of airports. Quantization measures of noise, such as perceived noise level are discussed, and the Q-formula developed for Germany is given. Possible means of engine noise reduction, such as bypasses, are shown. The noise situation in the vicinity of an airport is investigated, noting noise abatement profiles to reduce annoyance. A recent German law to limit aircraft noise is mentioned.
ESRO

N72-19032# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
AN INVESTIGATION OF THE PRESSURE DISTRIBUTIONS ON A 45 DEGREE SWEPT HALF WING, INCLUDING THE EFFECTS OF UPPER SURFACE SPOILERS
M. D. Dobson London Aeron. Res. Council 1971 95 p refs Supersedes RAE-TR-68118; ARC-31187
(ARC-CP-1184; RAE-TR-68118; ARC-31187) Avail: NTIS; HMSO: £1.25; PHI: $4.90

Pressure measurements, flow visualization tests and force measurements were made on 45 deg swept half wings, to examine the flow conditions which prevail, particularly in relation to the effectiveness of an upper surface spoiler as a roll control. Tests were made on 1/10 scale half-models in the 3ft x 3ft wind tunnel over a Mach number range 0.5 to 0.9. The wing flow is characterized by attached flow at low incidence and then at 4 deg to 5 deg, the occurrence of leading edge separation near the tip and consequent formation of an upper surface vortex. As incidence is increased the separation point moves inboard and the vortex strength increases. An unvented spoiler on the upper surface of the wing is effective under attached flow conditions but loses effectiveness as it comes under the influence of vortex flow. Venting the spoiler reduces its effectiveness under attached flow conditions but increases its effectiveness under vortex flow conditions.
Author (ESRO)

N72-19033# Glasgow Univ. (Scotland). Dept. of Aeronautics and Fluid Mechanics.
EXPERIMENTAL INVESTIGATION OF A HIGH-LIFT LOW-DRAG AEROFOIL
F. H. Kelling London Aeron. Res. Council 1971 37 p refs Supersedes ARC-30983
(ARC-CP-1187; ARC-30983) Avail: NTIS; HMSO: 60p; PHI: $2.55

One of a series of low-drag airfoils designated GU 25-5(11)8 was selected for low speed wind tunnel testing at Reynolds numbers around half a million. Coefficients of lift, drag and pitching moment were obtained for a range of incidence, using a two-dimensional wing. The maximum section lift coefficient

obtained was 1.93, and the minimum profile drag coefficient was 0.0112. Results compared favorably with those deduced theoretically. The addition of a boundary layer trip to the upper surface caused the profile drag to decrease at some incidences. At the design lift coefficient of 1.4, the ratio of lift to profile drag was 108 at a Reynolds number of 0.63 million. The addition of an extended, sealed, flat-plate flap, with a chord one tenth that of the airfoil, at the trailing edge of the airfoil gave favorable results. Author (ESRO)

N72-19034# Royal Aircraft Establishment, Farnborough (England). Aero Dept.
AN APPROXIMATE ANALYSIS OF THE NON-LINEAR LATERAL MOTION OF A SLENDER AIRCRAFT (HP 115) AT LOW SPEEDS
A. Jean Ross and L. J. Beecham London Aeron. Res. Council 1971 34 p refs Supersedes RAE-TR-70085; ARC-32345
(ARC-R/M-3674; RAE-TR-70085; ARC-32345) Avail: NTIS; HMSO: £1.25; PHI: $4.90

An approximate analytical method is developed for the solution of a fourth order, nonlinear equation of motion from which the frequency and amplitude of a sustained oscillation may be derived. The criterion for the existence of the limit cycle is a modified form of Routh's discriminant, its sign, and the sign of its derivative with respect to the square of the instantaneous amplitude. Comparisons at spot points show excellent agreement with exact digital computations. The method was applied to the lateral motion limit cycle encountered at low speeds on the HP 115 aircraft, and comparisons with the results of wind tunnel dynamic simulations show that the onset and nature of the sustained oscillation is predicted. Author (ESRO)

N72-19035# Bristol Univ. (England). Dept. of Aeronautical Engineering.
RESEARCH INTO SLUSH DRAG, WHEEL SPRAY AND AQUAPLANING AT BRISTOL UNIVERSITY USING SMALL PNEUMATIC TYRES
R. V. Barrett London Aeron. Res. Council 1971 19 p refs Supersedes ARC-32355
(ARC-R/M-3682; ARC-32355) Avail: NTIS; HMSO: 68 p; PHI: $2.95

The principle results and conclusions of research into slush drag, wheel spray and aquaplaning, using a moving runway and water layer model test facility, are described. The method has proved a valuable compliment to full scale research into these problems. Suggestions for future research are made.
Author (ESRO)

N72-19036# Transportation Systems Center, Cambridge, Mass.
LINEARIZED MATHEMATICAL MODELS FOR DE HAVILLAND CANADA BUFFALO AND TWIN OTTER STOL TRANSPORTS
R. A. MacDonald (Service Technol. Corp., Cambridge, Mass.), Mel Garelick, and J. Grady Jun. 1971 113 p refs
(AD-733756; DOT-TSC-FAA-71-8) Avail: NTIS CSCL 01/3

Linearized six degree of freedom rigid body aircraft equations of motion are presented in a stability axis system. Values of stability derivatives are estimated for two representative STOL aircraft, the DeHavilland of Canada 'Buffalo' and 'Twin Otter.' These estimates are based on analytical expressions included in the report. The combination of the equations of motion and the estimated stability derivatives provides an aircraft model which is useful for Navigation, Guidance and ATC Studies. Resulting transient responses to control inputs are presented. GRA

N72-19037# Office of Air Force History, Washington, D.C.
UNITED STATES AIR FORCE HISTORY. AN ANNOTATED BIBLIOGRAPHY
Mary Ann Cresswell and Carl Berger, comps. 1 Oct. 1971 111 p refs
(AD-733892) Avail: NTIS CSCL 01/3

Reports of American aircraft events at Fort Myer, Virginia, in 1908 and published extensively in the United States and Europe, marked the beginning of an immense flood of literature about military aviation and aviators, and air deeds in war and peace. This annotated bibliography on U. S. Air Force history is a sampling of that literature, prepared primarily for the student and scholar. GRA

N72-19038# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
FULL-SCALE WIND TUNNEL INVESTIGATION OF THE ADVANCING BLADE CONCEPT ROTOR SYSTEM Final Report
Vincent Paglino and Edward A. Beno Aug. 1971 830 p refs
(Contract DAAJ02-67-C-0102; DA Proj. 1F1-62203-A-143)
(AD-734338; SER-50705; USAAMRDL-TR-71-25) Avail: NTIS HC $9.00/MF $0.95 CSCL 01/3

A 40-foot-diameter ABC (coaxial) rotor system was tested in a 40 ft x 80 ft wind tunnel. The six rigid blades were instrumented to measure flatwise, edgewise, and torsional strain. Advance ratios up to 0.91 and tip Mach numbers to 0.83 were tested. Lateral displacement of individual rotor lift was varied. The performance, control, stress, and vibration data recorded during these tests are presented and discussed. Author (GRA)

N72-19039# Boeing Co., Philadelphia, Pa. Vertol Div.
THE 1/3 SCALE V/STOL CYCLIC PITCH PROPELLERS: RESULTS OF WIND TUNNEL TESTS Test Report, Nov. - Dec. 1970
Edward Widmayer and J. Tomassoni Feb. 1971 168 p refs
(Contract F33615-70-C-1000; AF Proj. 698BT)
(AD-734237; D170-10040-1; AFFDL-TR-71-91-Ref-5) Avail: NTIS CSCL 01/3

The report presents the results of a wind tunnel test performed in the Boeing-Vertol wind tunnel on a 1/3 scale V/STOL 4-bladed cyclic pitch propeller, having a total activity factor of 640. The propeller was tested as both an isolated propeller and as an installed propeller. The primary objectives of the test were to determine: the effectiveness of cyclic pitch control for longitudinal control during hover and transition, the change in power required for cyclic pitch control and blade and hub loads for use in design and for verification of analytical methods. Author (GRA)

N72-19040# Boeing Co., Philadelphia, Pa. Vertol Div.
FOUR PROP TILT WING WITH CYCLIC PITCH PROPELLERS: RESULTS OF FULL SPAN WIND TUNNEL TEST/PHASE 2
Charles E. Kolesar Jun. 1971 299 p refs
(Contract F33615-70-C-1000; AF Proj. 698BT)
(AD-734236; D170-10039-1; AFFDL-TR-71-91-Ref-4) Avail: NTIS CSCL 01/3

The report presents the results of wind tunnel test BVWT 067, the Phase II test of a two phase test program, performed in the Boeing-Vertol V/STOL wind tunnel on a powered four prop tilt wing full span model equipped with cyclic pitch propellers for longitudinal control. Items evaluated through transitional flight, include cyclic pitch effectiveness, descent performance with cyclic pitch inputs, the effect of cyclic on longitudinal and lateral/directional stability plus the influence of cyclic action on the effectiveness of the aircraft surface controls (stabilizer for longitudinal trim and differentially deflected flaps/spoiler for roll/yaw control). An in-ground effect investigation with a moving ground plane was also conducted to establish the influence of the ground on cyclic pitch effectiveness and on stability characteristics with cyclic pitch inputs. Author (GRA)

N72-19041# Army Edgewood Arsenal, Md.
AN ANALYSIS OF THE DYNAMIC AND AERODYNAMIC PERFORMANCE OF A SELF-DEPLOYING ARTICULATED AUTOROTOR DECELERATOR
Miles C. Miller Oct. 1971 192 p refs
(AD-734309; EA-SP-100-108) Avail: NTIS CSCL 01/3

The articulated autorotor decelerator is a device intended to provide retardation and stability to air delivered stores. This unique device, combining aerodynamics, dynamics, and gyroscopics, shows promise of having a significant potential in the decelerator field. Limited wind tunnel tests using small models indicate that this device gives the largest drag coefficient, based on solidity factor and tip speed ratio considerations, of any known decelerator, including parachutes. Author (GRA)

N72-19042# Northrop Corp., Hawthorne, Calif. Aircraft Div.
STUDY/TEST PROGRAM TO EVALUATE THE EFFECTS OF HIGH TEMPERATURE HYDRAULIC FLUID ON T-38 CONTROL SURFACE SERVOVALVES
R. A. Bartens and L. J. Mitts Dec. 1971 214 p
(AD-734259; NOR-71-217) Avail: NTIS CSCL 01/3

The test program included the following objectives: Conduct temperature survey on an instrumented T-38 aircraft, including a malfunction pump condition; Determine pilot corrective procedure; Simulate aircraft thermal environment on Northrop Hydraulic System Test Stand; Establish repeatable test techniques; Test servovalves having lap leakages of 3, 15, and 40 cc/min - approximately four valves; Correlate valve spool force and control stick force to lap leakage variation; Rework tight valves and retest to verify lap leakage criteria. GRA

N72-19043# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
THREE-AXIS FLUIDIC STABILITY AUGEMENTATION SYSTEM Flight Test Report, 1 Jan. - 17 Dec. 1970
Mark E. Ebsen, Harvey D. Ogren, and Donald H. Sotanski Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Sep. 1971 176 p
(Contract DAAJ02-70-C-0017)
(AD-734343; Rept-21476-FR; USAAMRDL-TR-71-34) Avail: NTIS CSCL 01/3

The report covers the flight test of a three-axis hydrofluidic stability augmentation system for a UH-1-type helicopter. The design goal was to improve the performance of the aircraft, without stabilizer bar, in the speed range of 60 to 120 kn. The system was installed in a UH-1C helicopter. The helicopter's hydraulic power supply was used to power the FSAS controllers and servoactuators. The system improved the performance of the UH-1C helicopter in all three axes by increasing the damping, increasing the phugoid mode period, and producing a constant vehicle rate proportional to cyclic stick input. Author (GRA)

N72-19044# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION IN THE LAND OF SOVIETS
Janusz Babiejczuk and Jerzy Grzegorzewski 23 Sep. 1971 437 p Transl. into ENGLISH of "Lotnictwo Kraju Rad" Warsaw, 1969 p 1-387
(AD-734069; FTD-HC-23-04-71) Avail: NTIS HC $6.00/MF $0.95 CSCL 01/2

The book deals with Soviet civilian aviation. The first historical chapter presents the story of Russian and Soviet aviation, both military and civilian. Subsequent chapters deal with current work of Aeroflot in passenger communication, agricultural aviation, and medical and special applications. More interesting achievements in sports aviation are given, design teams working for the needs of civilian aviation are introduced, and the aviation industry and some specific plants manufacturing planes and equipment for civilian aviation are described.
Author (GRA)

N72-19045# Coast Guard, San Francisco, Calif. Air Cushion Vehicle Evaluation Unit.
AIR CUSHION VEHICLE EVALUATION, SAN FRANCISCO/ POINT BARROW, ALASKA, 1 JANUARY - 31 AUGUST 1971 Evaluation Report
Thomas C. Lutton 15 Oct. 1971 183 p
(AD-734206; ACV-EU-3960-01) Avail: NTIS CSCL 01/3

The United States Coast Guard has conducted an extensive evaluation of three SK-5 air cushion vehicles to determine their potential usefulness in meeting the expanding missions and responsibilities of the service. The Coast Guard spent 1,400 hours operating the three craft while participating in 185 search and rescue cases. In addition, the vehicles were effectively used in servicing aids-to-navigation, on oil pollution and law enforcement missions, as well as numerous operations with other agencies. The report details the operations, the personnel and training requirements, the Arctic deployment, maintenance and operating costs, and new developments. Author (GRA)

N72-19046# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
VP OPTIMUM FLIGHT PATH Final Report, 1 Nov. 1970 31 Aug. 1971
Nelson R. Zagalsky and Robert P. Irons Sep. 1971 106 p refs
(Contract N00014-71-C-0138; NR Proj. 213-080)
(AD-734167; Rept-12648-FR) Avail: NTIS CSCL 01/2

Time optimal trajectories for the P-3C ASW aircraft are developed. The optimization program is based on the use of the Energy State Approximation and a unique graphical construct. Certain features of the program are verified by comparison to NATOPS manual flight test results, while verification of the actual time savings reported requires implementation of a recommended flight test program. This study establishes that flight path optimization procedures and a minimal data base can now be used in improving operational performance. For the P-3C application, increases in the average transit speeds of up to 70 knots were demonstrated. GRA

N72-19047# Boeing Co., Philadelphia, Pa. Vertol Div.
CYCLIC PITCH CONTROL ON A V/STOL TILT WING AIRCRAFT Final Report, Mar. 1970 - May 1971
Charles E. Kolesar Wright-Patterson AFB, Ohio AFFDL Oct. 1971 115 p refs
(Contract F33615-70-C-1000; AF Proj. 698BT)
(AD-734068; D210-10353-1; AFFDL-TR-71-91) Avail: NTIS CSCL 01/3

The report presents the key results of a model wing tunnel test program that was directed towards investigating the use of cyclic pitch propellers as the low speed longitudinal control system of a four propeller V/STOL tilt wing transport-type aircraft. The almost linear pitch control effectiveness of this system through transitional flight and in-ground effect along with the correlation with theory is discussed, and the moderate power increase associated with its use is shown. Author (GRA)

N72-19048# United Aircraft Corp., East Hartford, Conn.
VORTEX SHEDDING NOISE OF AN ISOLATED AIRFOIL Final Report, 30 Jun. 1969 - 28 Dec. 1971
Robert W. Paterson, Paul G. Vogt, Martin R. Fink, and C. Lee Munich Dec. 1971 121 p refs
(Contract DA Proj. 2O0-61102-B-33-G)
(AD-734433; K910867-6; AROD-8726-1-E) Avail: NTIS CSCL 20/1

The purpose of the study was to determine the vortex shedding noise characteristics of isolated airfoils in a Reynolds number range applicable to full-scale helicopter rotors. Measurements of far-field noise, airfoil surface pressure fluctuations, and correlation coefficients were obtained for three airfoils. Two models of differing thickness were tested as two-dimensional models (NACA 0012 and 0018 airfoils) and the third has a span of half the tunnel width (NACA 0012 airfoil). Airfoil vortex shedding noise was found to be discrete rather than broadband. The frequency dependence of this noise on velocity and chord was found to be well predicted by a constant Strouhal number near 0.2 referenced to laminar wake thickness at the airfoil trailing edge. The presence of a laminar boundary layer on the pressure surface of the airfoils was found to be critical to the presence of vortex shedding noise. Author (GRA)

N72-19049# Tactical Air Command, Langley AFB, Va. Office of Operations Analysis.
BIRD STRIKES IN LOW LEVEL CRUISE FLIGHT
Robert R. Graham Dec. 1971 27 p refs
(AD-734803; TAC-OA-WP-71-23) Avail: NTIS CSCL 01/2

A study of the overall efforts directed at reducing the probability of bird strikes showed that most of the activity has been concentrated on reducing those occurrences within the vicinity of airfields. An analysis of the limited available data pertaining to low level cruise flight indicates that the probability of a collision with a large bird would be reduced somewhat if the spring and fall migratory bird flyway routes and wintering areas could be avoided. Author (GRA)

N72-19050# Naval Postgraduate School, Monterey, Calif.
A LITERATURE SURVEY OF THE PROBLEM OF AIRCRAFT SPINS M.S. Thesis
Arne Edward Johnson Sep. 1971 67 p refs.
(AD-734976) Avail: NTIS CSCL 01/2

The prediction of aircraft spin characteristics has defied complete scientific analysis. There are, however, a number of research techniques which have been utilized in attempts to understand the mechanism of spin. This paper presents a survey of the literature dealing with spin research and its application to a wide variety of aircraft designs over the period 1916 to 1971. Author (GRA)

N72-19051# Honeywell, Inc., St. Paul, Minn. Systems and Research Center.
IRF STEEP ANGLE APPROACH: EFFECTS OF WIND, SYSTEM DATA RATE, AND CONTINGENCY EVENT VARIABLES Final Report, Jul. 1970 - Aug. 1971
James D. Wolf and Mike F. Barrett Dec. 1971 266 p refs
(Contract N00014-68-C-0191; NR Proj. 213-061)
(AD-734702; Rept-12571-FR3; JANAIR-711105) Avail: NTIS CSCL 01/2

The primary objective of the study was to investigate, by means of real-time man-in-the-loop simulation techniques, piloting performance as influenced by wind, system data-rate, and contingency-event variables during IFR steep approaches with vertical-lift aircraft. By also simultaneously evaluating effects of display-format, approach-angle and measurement-noise variables to the extent possible within the scope of each study task, an increased degree of generality of study results was obtained. A variable-velocity simulation of the Bell UH-1 helicopter served as the test vehicle in all study tasks. Author (GRA)

N72-19052# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. SOUTHERN AIRWAYS, INCORPORATED, DOUGLAS DC-9-15, N92S GULFPORT, MISSISSIPPI, 17 FEBRUARY 1971
1 Sep. 1971 21 p
(PB-204111; NTSB-AAR-71-14) Avail: NTIS CSCL 01B

On February 17, 1971 at approximately 0809 CST, a Southern Airways Douglas DC-9-15, N92S, struck an electric transmission line static cable during a VOR approach to Runway 31 at the Gulfport, Mississippi, Municipal Airport. A successful missed approach was accomplished, and the aircraft landed at Gulfport. The aircraft received substantial damage. There was no fire. The probable cause of the accident was inadequate monitoring of the approach. Author (GRA)

N72-19053# Naval Aerospace Medical Inst., Pensacola, Fla.
ORIENTATION-ERROR ACCIDENTS IN REGULAR ARMY AIRCRAFT DURING FISCAL YEAR 1968: RELATIVE INCIDENCE AND COST
Jorma I. Niven, W. Carroll Hixson, and Emil Spezia 8 Sep. 1971 45 p refs Prepared in cooperation with Army Aeromed. Res. Lab., Fort Rucker, Ala.
(AD-735119; NAMRL-1143; USAARL-72-4) Avail: NTIS CSCL 01/2

The report is the second in a longitudinal series of reports dealing with the pilot disorientation/vertigo accident problem in Army fixed wing and rotary wing flight operations. Incidence and cost data presented for fiscal year 1968 include a total of 75 major and minor orientation-error accidents (26 of which were fatal), resulting in 91 fatalities, 75 nonfatal injuries, and an over-all aircraft damage cost of $12,381,805. The contribution of rotary wing accidents to these totals was 66 accidents (21 of which were fatal), resulting in 80 fatalities, 70 nonfatal injuries, and an over-all aircraft damage of $9,077,065. Author (GRA)

N72-19054# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT OPERATIONAL AND PERFORMANCE CHARACTERISTICS
1 Nov. 1971 11 p refs
(AMCR Proj. 310-623)
(AD-734850; MTP-7-3-520) Avail: NTIS CSCL 01/3

The report describes a method for evaluation of Army aircraft operational and performance characteristics and provides procedures for test preparation, weight, balance, personnel training, operational and performance characteristics, weather effects, human factors, and safety. Author (GRA)

N72-19123# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
AIRCRAFT ACCIDENT INJURIES AND AIRCRAFT ACCIDENT RECONSTRUCTION
S. Krefft *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 11 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19129# Army Board for Aviation Accident Research, Fort Rucker, Ala.
ANALYSIS OF US ARMY HELICOPTER ACCIDENTS TO DEFINE IMPACT INJURY PROBLEMS
Joseph L. Haley, Jr. *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 13 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19141# Hughes Tool Co., Culver City, Calif. Aircraft Div.
DESIGNING HELICOPTERS FOR IMPROVED CRASH SURVIVABILITY
Henry G. Smith *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 14 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-19055*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAXIMUM POWER TRANSFER FROM A SOLAR-CELL ARRAY BY SENSING ARRAY TEMPERATURE
Merton Sussman Washington Mar. 1972 41 p refs
(NASA-TN-D-6678; L-8110) Avail: NTIS CSCL 10A

A technique is described in which a spacecraft solar-cell array is caused to operate at or near maximum power output over a wide range of environmental conditions. The output of an array temperature sensor is used to vary the duty cycle of a pulse-width-modulated impedance regulator so that the array operates at the voltage of maximum power. A resistance-type temperature sensor was found to be applicable for most

spacecraft missions. However, a solar cell used as a temperature sensor has the advantage of negligible transient errors on lightweight arrays for orbiting spacecraft. Author

N72-19056*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR BUS REGULATOR AND BATTERY CHARGER FOR IMP'S H, I, AND J
John Paulkovich Feb. 1972 20 p
(NASA-TM-X-65840; X-761-72-43) Avail: NTIS CSCL 10A

Interplanetary Monitoring Probe (IMP) spacecrafts H, I, and J utilize a direct energy transfer (DET) type of power system operating from a solar array source. A shunt type of regulator prevents the bus voltage from exceeding a preset voltage level. The power system utilizes a single differential amplifier with dual outputs to control the battery charge/shunt regulator and the discharge regulator. A two-voltage level, current limited, series charger and a current sensor control battery state of charge of the silver-cadmium battery pack. Premature termination of the battery charge is prevented by a power available gate that also initiates charge current to the battery upon availability of excess power. Author

N72-19057*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE-SCALE TERRESTRIAL SOLAR CELL POWER GENERATION COST: A PRELIMINARY ASSESSMENT
Adolph E. Spakowski and Lloyd I. Shure Mar. 1972 13 p refs
(NASA-TM-X-2520; E-6675) Avail: NTIS CSCL 10A

A cost study was made to assess the potential of the large-scale use of solar cell power for terrestrial applications. The incentive is the attraction of a zero-pollution source of power for wide-scale use. Unlike many other concepts for low-pollution power generation, even thermal pollution is avoided since only the incident solar flux is utilized. To provide a basis for comparison and a perspective for evaluation, the pertinent technology was treated in two categories: current and optimistic. Factors considered were solar cells, array assembly, power conditioning, site preparation, buildings, maintenance, and operation. The capital investment was assumed to be amortized over 30 years. The useful life of the solar cell array was assumed to be 10 years, and the cases of zero and 50-percent performance degradation were considered. Land costs, taxes, and profits were not included in this study because it was found too difficult to provide good generalized estimates of these items. On the basis of the factors considered, it is shown that even for optimistic projections of technology, electric power from large-scale terrestrial use of solar cells is approximately two to three orders of magnitude more costly than current electric power generation from either fossil or nuclear fuel powerplants. For solar cell power generation to be a viable competitor on a cost basis, technological breakthroughs would be required in both solar cell and array fabrication and in site preparation.
Author

N72-19058*# AiResearch Mfg. Co., Los Angeles, Calif.
PRELIMINARY DESIGN OF AN AUXILIARY POWER UNIT FOR THE SPACE SHUTTLE. VOLUME 1: SUMMARY
M. L. Hamilton and W. L. Burriss Washington NASA Mar. 1972 22 p
(Contract NAS3-14408)
(NASA-CR-1993; Rept-71-7300-1-Vol-1) Avail: NTIS CSCL 10A

Numerous candidate APU concepts are considered, each meeting the space shuttle APU problem statement. Evaluation of these concepts indicates that the optimum concept is a hydrogen-oxygen APU incorporating a recuperator to utilize the exhaust energy and using the cycle hydrogen flow as a means of cooling the component heat loads. A preliminary design of the selected APU concept is presented, placing primary emphasis on the cycle thermal management and the controls. Results for both steady state and transient APU performance are also included, based on digital computer programs developed during the study. The selected APU provides up to 400 hp out of the gearbox, has a fixed weight of about 277 lb, and requires about 2 lb/shp-hr of propellants. Author

N72-19059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS AND PERFORMANCE OF PARALLELING CIRCUITS FOR MODULAR INVERTER-CONVERTER SYSTEMS
Arthur G. Birchenough and Francis Gourash Washington Mar. 1972 18 p refs
(NASA-TN-D-6713; E-6715) Avail: NTIS CSCL 10A

As part of a modular inverter-converter development program, control techniques were developed to provide load sharing among paralleled inverters or converters. An analysis of the requirements of paralleling circuits and a discussion of the circuits developed and their performance are included in this report. The current sharing was within 5.6 percent of rated-load current for the ac modules and 7.4 percent for the dc modules for an initial output voltage unbalance of 5 volts. Author

N72-19060*# Scientific Translation Service, Santa Barbara, Calif.
ELECTRIC POWER SUPPLIES REQUIRED FOR ION PROPULSION: PRINCIPAL CHARACTERISTICS
C. Landrault, P. Luquet, and M. Briot Washington NASA Mar. 1972 34 p refs Transl. into ENGLISH from Alimentations Electriques Necessaires a la Propulsion Ionique: Principales Characteristiques, Lab. d'autom. et de Appl. Spatiales, Toulouse, report LAAS-756, Jan. 1971 40 p
(Contract NASw-2035)
(NASA-TT-F-14214; LAAS-756) Avail: NTIS CSCL 10B

Based on a bibliographic survey the main ion thrustors are reviewed. The different electric power supplies and their characteristics are discussed. A project of microthrustors designed for CNES is presented. Author

N72-19061# Sandia Labs., Albuquerque, N.Mex. Hazard Definition and Evaluation Div.
PIONEER RTG SAFETY EVALUATION: PHASE 1 IMPACT AND LAUNCH ABORT SEQUENTIAL TESTS
F. L. Baker and R. C. Cranfill May 1971 89 p Sponsored by AEC
(SC-DR-71-0101) Avail: NTIS

Phase 1 impact and the launch abort sequential tests were performed to investigate the Pioneer RTG heat source response to post-reentry impacts and Atlas/Centaur/TE-364 launch abort environments. A description of each test and the results are presented. The test levels used in this test program were based on reference environments defined as the maximum levels expected from the various aborts. Thus, these levels are considered conservative. The response of the capsules to the environments imposed was generally good. However, two capsules in the impact tests and two capsules in the solid propellant direct contact fire test were breached. Author (NSA)

N72-19062# Aeronautical Research Council (Gt. Brit.). Auxiliary Power Systems Div.
A FEASIBILITY STUDY ON A 200 VOLT, DIRECT CURRENT, AIRCRAFT ELECTRICAL POWER SYSTEM
1971 50 p refs Supersedes RAE-TR-70012; ARC-32640
(ARC-CP-1186; RAE-TR-70012; ARC-32640) Avail: NTIS; HMSO: 90p; PHI: $3.65

For comparative purposes, a 200 volt dc system for a large modern commercial aircraft has been designed and its weight compared with that of a conventional three-phase ac system. To obtain necessary design information, studies have been made of a 50 kW brushless dc generator, the problem of circuit interruption, conversion equipment and brushless motors. The vulnerability of the system due to the possibility of sustained arcs during fault conditions has also been examined. It is concluded that until considerable weight reduction can be

achieved in the design of conversion equipment and brushless motors, the dc system will not be lighter than the ac system. It is also concluded that the 200 volt dc system would be vulnerable to catastrophic dc arcing at altitude especially in a military aircraft subject to combat damage. Author (ESRO)

N72-19063# Eagle-Picher Co., Joplin, Mo. Couples Dept.
BATTERY, NICKEL-CADIUM BB-460( )/V Final Report, Mar. 1970 - Apr. 1971
Harry L. Brown and Earl S. Carr Nov. 1971 45 p
(Contract DAAB07-70-C-0146)
(AD-733890; ECOM-0146-F) Avail: NTIS CSCL 10/3

The report discusses the design and testing of a high energy density BB-460()/U vented nickel-cadmium 20 ampere-hour battery. These batteries were subjected to U. S. Army environmental level testing. GRA

N72-19064# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MANUFACTURE AND USE OF ATOMIC BATTERIES
H. Schaefer 22 Sep. 1971 37 p refs Transl. into ENGLISH from Isotopenpraxis (East Germany), v. 6, no. 1, 1970 p 1-11
(AD-734219; FTD-HT-23-973-71) Avail: NTIS CSCL 10/3

A study was made of the development and use of atomic powered batteries as energy sources in space research and operations. Their characteristics are compared with those of chemical batteries and advantages and disadvantages are pointed out, including economic factors favoring or disfavoring their use. The various methods of converting radioactive decay energy into electrical energy are considered along with the various methods of constructing the batteries. GRA

N72-19065# Static Power, Inc., Newport Beach, Calif.
FEASIBILITY STUDY TO DEVELOP A dc LINK VSCF SYSTEM Final Report
Reinhold Braum and Jerome B. Murray Sep. 1971 204 p
(Contract F33615-68-C-1686; AF Proj. 3145)
(AD-734067; AFAPL-TR-71-64) Avail: NTIS CSCL 10/2

The Static Power Division of Gates Learjet Corporation proposed to the Air Force to design and build a variable speed constant frequency (VSCF) inverter system using the DC link approach. This approach has certain inherant advantages over mechanical systems, which are now in common use in the aircraft, or over other electronic inverter systems which do not employ the DC link principle. An electrical breadboard was constructed and tested. The program has shown that a DC link VSCF system offer superior electrical characteristics. It was also learned that it is extremely difficult to package the system within the small weight and volume required to make it attractive for aircraft use. Author (GRA)

N72-19066# Army Electronics Command, Fort Monmouth, N.J.
SOLAR CHARGER KIT EXPERIMENTAL
H. B. Seapker and J. W. Mount Nov. 1971 28 p
(DA Proj. 1S6-63719-DK-75)
(AD-734809; ECOM-3452) Avail: NTIS CSCL 10/2

The Solar Charger Kit was specifically developed to maintain the BB-501/U nickel-cadmium battery in service for the Integrated Observation System (IOS) AN/GVQ-10 when installed at remote observation post where no local power is available and supply replacements are frequently interdicted. The solar kit has broader application in any service wherever its output capacity is equal to the power demand. Author (GRA)

N72-19067# Energy Research Corp., Bethel, Conn.
SEALED NICKEL-ZINC RECHARGEABLE BATTERIES Semiannual Report, 1 Apr. - 30 Sep. 1971
Allen Charkey Dec. 1971 59 p ref
(Contract DAAB07-71-C-0134; DA Proj. 1T6-62705-A-053)
(AD-734927; ECOM-0134-S) Avail: NTIS CSCL 10/3

The purpose of the investigation is to develop a high energy density nickel-zinc battery that can operate in a sealed condition with no maintenance throughout its life. Inorganic separator materials fabricated from layer hydroxide and layer silicate materials were studied. They showed excellent resistance to zinc penetration compared to cellulosic separators on accelerated overcharge tests. Capacity maintenance data obtained indicate superior life for cells with layer hydroxide separators. Other studies concerned cells constructed with silver amalgam recombination electrodes and active carbon recombination electrodes. GRA

N72-19068# Air Force Systems Command, Wright-Patterson AFB, Ohio.
CYLINDRICAL REGENERATIVE FUEL CELL EVALUATION Technical Report, Apr. 1970 - Apr. 1971
Leo S. Harootyan, Jr. and Irvin F. Luke May 1971 152 p refs
(AF Proj. 3145)
(AD-734767; AFAPL-TR-71-31) Avail: NTIS CSCL 10/2

An experimental test evaluation was conducted of 20 cylindrical regenerative hydrogen-oxygen fuel cells manufactured by Electro-Optical Systems, Inc. The cells were operated in two test ovens controlled to maintain temperatures at 125F and 150F and were subjected to representative synchronous orbit load profiles, that is, charge of 22.8 hours and discharge for 1.2 hours. The cells were charged in series at constant current with termination of charge independently controlled by actuation of a pressure switch located on each cell. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-19069*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 96
Dec. 1971 148 p refs
(NASA-SP-7011(96)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N72-19070*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 97
Jan. 1972 95 p refs
(NASA-SP-7011(97)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N72-19071*# Stanford Univ., Calif. Instrumentation Research Lab.
CYTOTOXICITY ASSAY AUTOMATION Final Report, 17 Jun. 1969 - 31 Oct. 1971
Elliott C. Levinthal and Rose O. Payne 31 Oct. 1971 45 p refs
(Grant NGR-05-020-004; Contract AI-69-2064; Grant AI-17367)
(NASA-CR-125590; IRL-1129) Avail: NTIS CSCL 06M

The design and construction of a system to automatically test HLP antigens are described. Major efforts were made to test and evaluate the performance of such a system, and compare its performance with nonautomatic tissue typing techniques. The system is based on the fluorochromatic cytotoxicity assay. Results show the system will work but is subject to malfunctions after a few samplings, and poses problems in showing correctly the necessary readings. E.H.W.

N72-19072*# Comar Space/Defense Corp., Birmingham, Mich.
RESEARCH TO DETERMINE THE ROLE OF GRAVITY IN NEUROSECRETORY PHYSIOLOGY Final Report
L. E. Clemens and J. S. Life 31 Jan. 1972 23 p refs
(Contract NASw-2196)
(NASA-CR-125689; TR-72-101) Avail: NTIS CSCL 06P

In an effort to determine the effects of gravity in regulating the synthesis, transport, storage, and release of octopeptides from the hypothalamo-neurophypophyseal system, the teleost fresh water fish was studied. A labyrinthectomized fish was subjected to a gravitational orientation of -G sub z for three days. Results show the fish had reduced levels of adenyl cyclose activity in its kidneys when compared to labyrinthectomized and unoperated fish exposed to normal gravitational orientation (+G sub 2) for the same period of time. Efforts were also made to determine the presence of vasopressin in the neurophypophysis and peripheral target organs. E.H.W.

N72-19073*# Texas A&M Univ., College Station. Dept. of Biochemistry and Biophysics.
THE EFFECTS OF SPACECRAFT ENVIRONMENTS ON SOME HYDROLYTIC ENZYME PATTERNS IN BACTERIA Final Report
J. M. Prescott and B. G. Foster 29 Sep. 1971 34 p refs
(Contract NAS9-7951)
(NASA-CR-125805) Avail: NTIS CSCL 06M

The effects of space flight on the production and characteristics of proteolytic enzymes are studied for a number of bacterial species isolated from crew members and spacecraft. Enzymatic make-up and cultural characteristics of bacteria isolated from spacecraft crew members are determined. The organism Aeromonas proteolytica and the proteolytic enzymes which it produces are used as models for future spacecraft experiments. Author

N72-19074# Joint Publications Research Service, Washington, D.C.
BIOLOGICAL EFFECT OF EXTREME ENVIRONMENTAL FACTORS
6 Mar. 1972 165 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (Leningrad), v. 61, no. 11, Nov. 1971 p 5-127
(JPRS-55341) Avail: NTIS

Morphological effects of the space flight environment on biological, organic, vascular, muscular, and nervous systems are considered from the anatomic and cytochemical standpoints. For individual titles, see N72-19075 through N72-19092.

N72-19075# Joint Publications Research Service, Washington, D.C.
SOME OF THE RESULTS AND PROSPECTS IN SPACE ANATOMY OF THE VASCULAR SYSTEM
M. G. Prives *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 1-16 refs (See N72-19074 10-04)
Avail: NTIS

Adaptation of the vascular human mechanism to weightlessness and the reverse process of readaptation to earth's gravity is studied by observing: the influence of stress factors induced by high altitude and space flights; the discovery of the patterns of such influences on the structure of the vascular and nervous system; and the development of conditioning regimes to prevent pathologic anatomical changes. The need to combine physiological data about the effects of gravitational stress on the vascular system with anatomical data is pointed out for the locomotor system whose function is constricted in hypokinesia and hypodynamia, the cardiovascular system, and the human body as a whole. Under the influence of g forces, macro- and microscopic changes in the structure of the vascular system consist of irregular constriction or dilation, increased vascular wall permeability, and slower formation of blood and lymph collaterals. G.G.

N72-19076# Joint Publications Research Service, Washington, D.C.
THE EFFECT OF G FORCES ON THE MICROCIRCULATORY SYSTEM
V. V. Kupriyanov and V. G. Petrukhin *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 17-33 refs (See N72-19074 10-04)
Avail: NTIS

The various morphological effects of gravitational forces on animal microcirculatory systems are attributed to the possible role of adaptational vascular mechanisms for preventing pathological manifestations of the functional disorders. It is shown that animal training prior to gravitational stress as a positive factor increases resistance to physical stress, alleviates the degree of morphological changes, and prevents possible breakdown of the circulatory system. G.G.

N72-19077# Joint Publications Research Service, Washington, D.C.
THE CONDITION OF NEURONS IN THE AUTONOMOUS NERVOUS SYSTEM GANGLIA FOLLOWING EXPOSURE TO G FORCES
Ye. A. Dyskin and L. P. Tikhonova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 34-41 refs (See N72-19074 10-04)
Avail: NTIS

Gravitational stress effects on the neurons of some ganglia of the autonomous nervous systems in animals were studied by observing respiration and EKG tracings of cats during hypergravitation and by studying the paravertebral and prevertebral ganglia of their sympathetic nervous systems as well as the nodose ganglion of the vagus nerve after sacrifice. Some of the nerve cells underwent vacuolization and different sized vacuoles appeared in their cytoplasms. In some neurons, different sized vacuoles filled the entire cytoplasms. In other neurons, the nuclei often occupied eccentric positions and were markedly enlarged. Considerably more altered neurons in the nodose ganglion of the vagus indicate that the afferent neurons of the vagal ganglion are involved more than the efferent neurons of the cranial cervical ganglion. It is concluded that the above described changes cannot be attributed solely to gravitational force effects and could also be secondary to hemodynamic disturbances. G.G.

N72-19078# Joint Publications Research Service, Washington, D.C.
THE EFFECT OF TRANSVERSE G FORCES ON ATRIAL NERVE CELLS (EXPERIMENTAL MORPHOLOGICAL INVESTIGATION)
S. S. Mikhaylov, V. M. Klebanov, and S. I. Yevloyev *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 42-54 refs (See N72-19074 10-04)
Avail: NTIS

Changes in the nerve cells of the atrium following accelerations, the possibility of developing tolerance and

adaptation to gravitational stress, as well as accumulation of gravitational factors were studied on dogs. It was found that the neurons of the heart's nervous system demonstrate the greatest reactions to acceleration. Even at 9 g, there was a reversible neuronal reaction which reverted to normal within a rather short time after the experiment ended. Single massive (21.7 g) or multiple accelerations (up to 9 g) induced considerably greater morphological changes in the nervous system of the heart and some neurons perished. However, because of the development of compensatory processes, nerve structures were restored and cardiac function was completely normalized after 1 to 2 months.
G.G.

N72-19079# Joint Publications Research Service, Washington, D.C.

THE EFFECT OF TRANSVERSE G FORCES ON NERVE ELEMENTS OF THE RAT'S PHARYNGEAL AND ESOPHAGEAL NERVE ELEMENTS FOLLOWING PRELIMINARY EXPOSURE TO A CONSTANT MAGNETIC FIELD

V. P. Golev and G. V. Chepelenko *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 55-58 refs (See N72-19074 10-04)
Avail: NTIS

Morphological findings are reported on nerve elements of the rat's pharynx and esophagus following exposure to a magnetic field and additional exposures to transverse accelerations. Reactive, dystropnic, and destructive changes indicate a protective stage of the reactive process in the neuroplasma. Intensities of these processes are relative to force and duration of exposure to physical factors, and also to prior excitation of the nervous system.
G.G.

N72-19080# Joint Publications Research Service, Washington, D.C.

CHANGES IN TROPIC FUNCTION OF THE EMBRYONIC LIVER UNDER THE INFLUENCE OF TRANSVERSE G FORCES (PLUS G x)

S. K. Konshina, V. I. Stepantsov, and A. V. Yeremin *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 59-65 refs (See N72-19074 10-04)
Avail: NTIS

The glycogen synthesizing function of the embrionic mouse liver after transverse acceleration stress was observed. Comparative quantitative assays of glycogen content in the livers of various animals revealed dilated, plethoric hepatic vessels with a decrease in glycogen mainly due to disappearance of large clumps of glycogen from the periphery of the lobes. Glycogen replenishment started one day after exposure and complete reaccumulation of glycogen occurred on the third day. Livers of embryos whose mothers were exposed to accelerations revealed high glycogen contents in all hepatic lobes. These findings are interpreted as protective reactions against exogenous factors.
G.G.

N72-19081# Joint Publications Research Service, Washington, D.C.

THE EFFECT OF CHEST-BACK G FORCES ON TELENCEPHALIC VESSELS

N. I. Zotova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 66-71 refs (See N72-19074 10-04)
Avail: NTIS

Gravitational stress in the chest-back direction induced morphogical changes in the entire vascular system of the rabbit telencephalon. Functionally tolerable g forces constricted arteries and dilated veins as a result of venous stasis. Maximum tolerable and intolerable forces induced more severe changes in the vessels and are indicative of impairment of the adaptational reflex mechanism of the vascular system. Forces constituting 10 units used for 25 to 45 minutes were at the upper tolerance limit for the animals and ultimately caused their death.
G.G.

N72-19082# Joint Publications Research Service, Washington, D.C.

THE EFFECT OF BACK-CHEST G FORCES ON METENCEPHALIC AND MESENCEPHALIC BLOOD VESSELS

I. N. Preobrazhenskaya *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 72-77 refs (See N72-19074 10-04)
Avail: NTIS

Gravitational stress in the chest-back direction introduced very definite morphological changes in the structures of blood vessels of the rabbit medulla, pons, and mesencephalon. Constrictions of the arteries and considerable dilation of the brain stem veins were observed. It is concluded that stasis of the brain stem characterized the effect of ventral gravitational stress.
G.G.

N72-19083# Joint Publications Research Service, Washington, D.C.

THE EFFECT OF ACCELERATOR TRAINING ON THE RABBIT'S RETINAL VESSELS

L. I. Savinova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 78-84 refs (See N72-19074 10-04)
Avail: NTIS

Compensatory reactions of rabbit retinal vessels to repeated acceleration exposures indicated increased resistance to gravitational stress as a result of training. The quality of the retinal vascular bed improved, filling was more even and complete, there were many capillaries, and the outlines of the vessels became more clearcut. A complete correlation between the degree of resistance to gravitational stress and morphological observations of the retinal vascular system was not obtained.
G.G.

N72-19084# Joint Publications Research Service, Washington, D.C.

THE EFFECT OF ACCELERATOR TRAINING ON SPLENIC RETICULAR TISSUE

S. G. Guseynova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 85-89 refs (See N72-19074 10-04)
Avail: NTIS

The reticular tissue of the spleen changes under the effect of gravitational stress, depending on the magnitude, direction, and duration of such exposure. Under the effect of longitudinal accelerations the changes in architectonics of reticular tissue amount to increased density of networks, new formation and tortuosity of fibers with degenerative areas. Under the effect of transverse accelerations the architectonics of reticular tissue do not differ markedly from normal. These changes are apparently compensatory in nature.
Author

N72-19085# Joint Publications Research Service, Washington, D.C.

CHANGES IN SKELETAL MUSCLES ASSOCIATED WITH INACTIVITY

G. S. Katinas and A. N. Potapov *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 90-99 refs (See N72-19074 10-04)
Avail: NTIS

Although it is often considered that weightlessness during an actual spaceflight and hypokinesia have much in common, the results of this study indicate that restricted movement in space (hypokinesia proper) and decreased force of muscular contractions do not have the same effect on skeletal muscles. In a series of experiments, qualitative changes of a histochemical nature were prominent; these were not observed following amputation. In both cases there was a consistent change in size of muscle fibers and muscle weight related to the biomechanical conditions.
Author

N72-19086# Joint Publications Research Service, Washington, D.C.

STRUCTURAL AND CYTOCHEMICAL CHANGES IN THE RAT'S SKELETAL MUSCLES ASSOCIATED WITH

RESTRICTED MOBILITY
V. V. Portugalov, Ye. I. Ilina-Kakuyeva, V. I. Starostin, K. D. Rokhlenko, and Z. F. Savik *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 100-111 refs (See N72-19074 10-04)
Avail: NTIS

Muscular fiber degeneration and marked decrease in enzyme activity constitute impairment of the metabolic processes in rat skeletal muscles exposed to hypokinesia. Atrophy of soleus muscle fibers was observed after 30 days confinement, whereas signs of hypertrophy were demonstrated before this time. Hypokinetic side effects on the structure of striate muscles are: Local disturbances in blood supply concurrent with pathological changes, perivascular round cell infiltration primarily around the arteries, vacuolar degeneration, and necroses in the peripheral parts of the muscles. G.G.

N72-19087# Joint Publications Research Service, Washington, D.C.
THE EFFECT OF HYPOKINESIA AND HYPODYNAMIA ON INTRAORGANIC CARDIAC ARTERIES
L. A. Aleksina *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 112-116 refs (See N72-19074 10-04)
Avail: NTIS

The effects of hypodynamia and hypokinesia on rabbit cardiac arteries are studied in an effort to evaluate possible morphological changes in the vascular beds of the hearts of patients who have been on prolonged bed rest, and in astronauts during space flight associated with restricted movement and weightlessness. It was found that after two weeks of restricted motor activity, the myocardial capillaries constricted considerably and the arterioles were dilated. All of the described changes progressed during prolonged immobility and resulted in impairment of myocardial structures. It was concluded that the degree of change in the vascular bed is related to the duration of the restricted motor activity. G.G.

N72-19088# Joint Publications Research Service, Washington, D.C.
MORPHOLOGICAL CHANGES IN BRONCHIAL VESSELS ASSOCIATED WITH EXPERIMENTAL HYPODYNAMIA AND HYPOKINESIA
V. S. Baybara *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 117-121 ref (See N72-19074 10-04)
Avail: NTIS

Hypodynamia and hypokinesia induced changes in rabbit bronchial vessels produced degeneration in the capillary region, edema of muscle cells, hemostatis and microvaricosities. It is shown that morphological reactions in the bronchial microcirculatory bed depend on the duration of hypodynamia and hypokinesia. G.G.

N72-19089# Joint Publications Research Service, Washington, D.C.
THE EFFECT OF GENERALIZED HYPODYNAMIA AND HYPOKINESIA ON THE PORTAL SYSTEM OF THE LIVER
A. V. Drozdova *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 122-127 refs (See N72-19074 10-04)
Avail: NTIS

Generalized hypodynamia and hypokinesia of the organism lasting one week to six months induced morphological changes in the portal system of the liver. This was manifested by constriction of small branches of segmentary and interlobular veins in the marginal segments or in the form of foci in different lobes. The segmentary and main branches of the portal vein dilated somewhat or else did not change. These phenomena progressed up to the 4th-6th week, then became stabilized.
Author

N72-19090# Joint Publications Research Service, Washington, D.C.
THE EFFECT OF HYPODYNAMIA AND HYPOKINESIA ON THE ARTERIAL BED OF THE RABBIT'S HIND LEGS
Z. A. Saryyeva *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 128-134 refs (See N72-19074 10-04)
Avail: NTIS

Prolonged hypodynamia and hypokinesia induces body weight loss with considerable atrophy of the leg muscles. During the first two weeks of hypodynamia and hypokinesia there is a change in architectonics of the arterial bed, as manifested by visible constriction of secondary and tertiary branches of major vessels of both the anterior and posterior femoral muscle groups, as well as leg muscles. The arteries become straighter and extended. The intramuscular network appears to be constricted. After 24 weeks, against a background of considerable atrophy of anterior and posterior femoral muscle groups, the major vessels appear wider than normal. Their secondary and tertiary branches, however, are extended and constricted. Anastomoses are poorly demonstrable between the branches. The intramuscular network is scanter, and the fine vessels are constricted. Author

N72-19091# Joint Publications Research Service, Washington, D.C.
THE EFFECT OF HYPODYNAMIA AND HYPOKINESIA AND SUBSEQUENT HYPERGRAVITATION ON THE BLOOD VESSELS OF THE CAPSULE OF THE RABBIT'S KNEE JOINT
A. G. Lubeyev *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 135-141 refs (See N72-19074 10-04)
Avail: NTIS

It is demonstrated that hypodynamia and hypokinesia affect the vascular system of the rabbit's knee joint capsule and, within the first few weeks, lead to vascular dystonia, hypostasis, and, later on, to onset of hypertensive form of hemodynamic disorders. Hypergravitation following hypokinesia leads to destructive changes in the vascular system of the knee joint capsule. The results of these experiments supplement data obtained previously and furnish information about the effect on the organism of two stress factors: hypergravitation, hypodynamia and hypokinesia. Author

N72-19092# Joint Publications Research Service, Washington, D.C.
AGE RELATED CHANGES IN VASCULARIZATION OF THE RAT'S SKELETAL MUSCLES AS RELATED TO NATURE OF EXERCISE
G. N. Lenskaya *In its* Biol. Effect of Extreme Environ. Factors 6 Mar. 1972 p 142-150 refs (See N72-19074 10-04)
Avail: NTIS

In the rat's skeletal muscles the mean diameter of muscle fibers increases with age. With increase in size of muscle fibers in the course of ontogeny, there is a decrease in number of capillaries per unit of cross section area of muscle and increase in quantity of capillaries per muscle fiber. There is almost no change in correlation between total capillary and fiber perimeters with age. Moderate physical loads induce insignificant changes in blood supply to the rat's skeletal muscles. Increased loads induce an increase in number of capillaries, increase in capillary diameter and their total area. Thus, different training regimens in the form of swimming induced different intensities of reorganization of the blood supply system of muscles. Author

N72-19093*# Aerojet Medical and Biological Systems, El Monte, Calif.
DEVELOPMENT OF A TAPE TRANSPORT BACTERIAL DETECTION SYSTEM Final Report
S. Witz and W. H. Hartung 25 Feb. 1972 107 p refs
(Contract NAS9-11644)
(NASA-CR-115457; Rept-1102F) Avail: NTIS CSCL 06M

The feasibility of a tape transport chemiluminescence system for bacterial monitoring of regenerated water was demonstrated using a manually operated laboratory breadboard. The principle of detection is based on measuring the increase in chemiluminescence produced by the catalytic action of bacterial porphyrins on a luminol-hydrogen peroxide mixture. Viable

organisms are distinguished from nonviable by comparing the signals of incubated and unincubated water samples. Using optimized protocols, sensitivities were obtained with 400 ml suspensions of E. coli and Cl. sporogenes. The sensitivity of the unincubated cycle E. coli (aerobe) was found to be 30 to 35 cells/m1, and that of the Cl. sporogenes (anaerobe) was 1000 to 10,000 cells/m1. The lower sensitivity toward Cl. sporogenes is attributed to several factors, namely the lower cytochrome content, the tendency to sporulate, long lag periods and the lower growth rate of Clostridia in general. The operational procedures used for processing the incubated and unincubated samples involved the following sequence: (1) concentrating the sample by filtration through a membrane filter, (2) washing with Dextrose-Thioglycollate Broth (3) incubating (0 to 4 hrs as required), (4) washing with 4M Urea, and (5) reacting with reagent in front of a photomultiplier tube. The signal output was recorded on a strip chart recorder. Author

N72-19094*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETARY QUARANTINE Semiannual Review, 1 Jul. - 31 Dec. 1970
[1971] 143 p refs Sponsored by NASA
(NASA-CR-125688; JPL-900-484) Avail: NTIS CSCL 06M

Methods for presterilization cleaning or decontamination of spacecraft hardware to reduce microbial load, without harming materials or spacecraft components, are investigated. Three methods were considered: (1) chemicals in liquid form, relying on physical removal as well as bacterial or bacteriostatic action; (2) chemicals used in the gaseous phase, relying on bacterial activity; and (3) mechanical cleaning relying on physical removal of organisms. These methods were evaluated in terms of their effectiveness in microbial burden reduction and compatibility with spacecraft hardware. Results show chemical methods were effective against spore microorganisms but were harmful to spacecraft materials. Mechanical methods were also effective with the degree depending upon the type of instrument employed. Mechanical methods caused problems in handling the equipment, due to vacuum pressure damaging the very thin layered materials used for shielding, and the bristles used in the process caused streaks or abrasions on some spacecraft components. E.H.W.

N72-19095# Public Health Service, Washington, D.C.
HEALTH ASPECTS OF SMOKING IN TRANSPORT AIRCRAFT
Dec. 1971 93 p refs
Avail: NTIS

An investigation was conducted to define the levels of certain combustion by-products of tobacco produced by passengers' smoking; to determine passengers' subjective reaction to tobacco smoke; and to obtain passenger opinion on the need for regulatory change regarding the control of smoking in commercial passenger airplanes. The study involved (1) the collection of samples to determine the environmental exposure levels to carbon monoxide, particulate matter, polynuclear hydrocarbons, ammonia, and ozone, and (2) the use of a questionnaire. The results of environmental sampling revealed very low levels of each contaminant measured, much lower than those recommended in occupational and environmental air quality standards. These combustion products were judged not to represent a hazard to the nonsmoking passengers. However, an evaluation of the results of the questionnaire indicated that a significant proportion of the nonsmokers (over 60%) were bothered by tobacco smoke and suggested that corrective action be taken such as segregation of the smokers. Furthermore, over 70% of the nonsmokers who had history of respiratory conditions expressed annoyance by tobacco smoke. Author

N72-19096# Joint Publications Research Service, Washington, D.C.
DYNAMICS OF CHANGES IN THE COMPOSITION OF THE ESCHERICHIA IN PERSONS PARTICIPATING IN A MEDICAL-TECHNICAL EXPERIMENT
M. P. Bragina, N. V. Anikeycheva, V. M. Shilov, and D. G. Kublay 15 Feb. 1972 10 p refs Transl. into ENGLISH from Zh. Mikrobiol. Epidemiol. i Immunobiol. (Moscow), no. 12, 1971 p 23-28
(JPRS-55191) Avail: NTIS

Changes in the composition of normal intestinal microflora were investigated in relation to cosmonaut confinement in a hermetically sealed cabin during long space flights. Cultures of E. coli were used in tests of antagonistic activity; these were excreted from persons who participated in the year-long experiment. The purpose of the investigations was to study the dynamics of compositional changes in Escherichia in persons confined in sealed chambers with limited volume. The colicinogenic Escherichia were typed and the spectrum of sensitivity of the strains to various colicins was determined. It was concluded that colicinogenicity can be used in the study of quantitative and qualitative changes in intestinal microflora. An intensive exchange of flora was observed to take place under the conditions of the experiment. K.P.D.

N72-19097# Royal Aircraft Establishment, Farnborough (England).
ANTHROPOMETRY OF FLYING PERSONNEL IN THE ROYAL SWEDISH AIR FORCE
B. Andrae, J. Ekmark, and H. Laestadius Sep. 1971 57 p refs Transl. into ENGLISH of "Kroppsmatt foer Flygande Personal" Inst. of Aviation Med., Malmslaett, Sweden, Rept-68:9, 1968
(RAE-Lib-Trans-1502; BR27943; Rept-68:9) Avail: NTIS

During the year 1967-8 detailed anthropometry was carried out on a total of 240 flying personnel born 1925-7, 1939-40 and 1944. Factors influencing the general growth of the body are discussed and examples given from the study of increase in stature of Swedish inductees for military service during the last century. The measurements obtained and subsequent analysis have resulted in (1) suggested changes in standard requirements and enrollment regulations for flying personnel and (2) recommendations concerning future measurements and pattern for experiments. Author

N72-19098*# Scientific Translation Service, Santa Barbara, Calif.
THE NERVOUS SYSTEM AND STRESS (THE PRINCIPLE OF DOMINANCE IN PATHOLOGY)
G. I. Kositskiy and V. M. Smirnov Washington NASA Mar. 1972 274 p refs Transl. into ENGLISH of "Nervnaka Sistema i stress (O Printsipe Dominanty Patol.)" Moscow, Nauka Press, 1970
(Contract NASw-2035)
(NASA-TT-F-653) Avail: NTIS CSCL 06S

Results are given of experimental investigations indicating that the action of supplementary nonspecific stimuli on the organism produces a significant increase in the resistance of the organism to pathogenic stimuli, which is of great importance in the prophylaxis of disease. A critical role in the development of these phenomena is assigned to the phenomena of the inhibition of pathological processes by the creation of a nonspecific focus of the dominant stimulus. Author

N72-19099*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power Dept.
SEVENTEEN KETOGENIC STEROIDS EXCRETION IN CREWMEN IN A 90-DAY MANNED TEST OF AN ADVANCED REGENERATIVE LIFE SUPPORT SYSTEM
D. J. Myers and J. R. Wamsley Feb. 1972 31 p refs
(Contract NAS1-10717)
(NASA-CR-112020; MDC-G2828) Avail: NTIS CSCL 06P

Seventeen KGS (17-Ketogenic steroids) and Na/K were determined in 19 urine specimens collected by each of 4 crewmen during the 90-day test. The specimens represented 10% aliquots of 24-hour collections stored frozen onboard the simulator until passthrough. Electrolytes were analyzed immediately after sample passthrough while the steroids were

determined post-test on aliquots of the original sample held at 203 K. Steroid data was corrected for body weight and also for analytical variation in the laboratory urine pool control. Long-term nonspecific responses to low-level stress appear to be reflected by the individual and group mean 17-KGS excretion patterns. The first 39 and the last 20 days of the test were significantly different--and presumably more stressful to the crew--than the period from days 39 to 67. Reduction of adrenocortical function during the mid-test phase is attributed to either an adaptation to chronic or intermittent stress or was the result of an actual reduction in the operational demands of the test during this time. Most remarkable of the metabolic findings is the prevalance of high Na/K ratios and an abrupt peak on day 74 for all 4 crewmen. Author

N72-19100*# Scientific Translation Service, Santa Barbara, Calif.
THE PROPERTIES OF CARBOXYPEPTIDASE C FROM ORANGE LEAVES
B. Sproessler, H. Heilmann, E. Grampp, and H. Uhlig Washington NASA Mar. 1972 15 p refs Transl. into ENGLISH from Z. Physiol. Chem. (W. Berlin), v. 352, Nov. 1971 p 1524-1530
(Contract NASw-2035)
(NASA-TT-F-14186) Avail: NTIS CSCL 06A

A carboxypeptidase was isolated and purified from orange leaves. Using Z-Leu-Phe as the substrate, the specific activity of the purified enzyme was 2,500 mU/mg protein; pH optimum 5.3; maximum stability at pH 5.0; optimum temperature 40 - 50 C. The molecular weight determined by gel chromatography on Sephadex G-200 was 175,000 plus or minus 10,000. The isolectric point lay at pH 4.5 as determined by disc-electrofocusing. The enzyme preparation possessed esterase activity, but it was free from endopeptidase and aminopeptidase activity. Carboxypeptidase C has the combined substrate specificities of carboxypeptidases A and B. It removes the C-terminal aromatic, neutral, and acidic amino acids, but in addition it also removes the basic amino acids. Furthermore, proline bonds are hydrolyzed on both the amino and carboxyl side. Glycine is attacked slowly and Z-Gly-Pro is not hydrolyzed. Author

N72-19101*# Scientific Translation Service, Santa Barbara, Calif.
CHANGES IN SERUM ENZYME ACTIVITY AFTER A PHYSICAL LOAD
V. Krampl, M. Hubach, and I. Borsky Washington NASA Mar. 1972 12 p refs Transl. into ENGLISH from Pracovni Lekar. (Prague), v. 18, 1966 p 150-153
(Contract NASw-2035)
(NASA-TT-F-14187) Avail: NTIS CSCL 06S

The activity of the glutamo-oxalacetic-, the glutamopyruvic transaminase, and aldolase in serum was investigated experimentally after a physical, dynamic, and static load. The activity increased significantly immediately after work approximately in an equal value regardless of the degree and the kind of load. After a greater load, the increase peak was reached in the 5th recovery minute; the result was significant in comparison with the initial value. In the 5th recovery minute a significant difference of activity of the enzyme investigated was observed between the smaller and the greater physical load.
Author

N72-19102*# BioTechnology, Inc., Falls Church, Va.
HUMAN FACTORS ASPECTS OF AIR TRAFFIC CONTROL
Harry J. Older and Bernard J. Cameron Washington NASA Feb. 1972 172 p refs
(Contract NAS1-9125)
(NASA-CR-1957) Avail: NTIS CSCL 05E

An overview of human factors problems associated with the operation of present and future air traffic control systems is presented. A description is included of those activities and tasks performed by air traffic controllers at each operational position within the present system. Judgemental data obtained from controllers concerning psychological dimensions related to these tasks and activities are also presented. The analysis includes consideration of psychophysiological dimensions of human performance. The role of the human controller in present air traffic control systems and his predicted role in future systems is described, particularly as that role changes as the result of the system's evolution towards a more automated configuration. Special attention is directed towards problems of staffing, training, and system operation. A series of ten specific research and development projects are recommended and suggested work plans for their implementation are included. Author

N72-19103# California Univ., Berkeley. Lawrence Radiation Lab.
INVESTIGATIONS OF BONDING, STRUCTURE, AND QUANTITATIVE ANALYSIS IN BIOLOGICAL SYSTEMS BY MEANS OF X-RAY PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis
Leo Nichols Kramer Jul. 1971 114 p refs
(Contract W-7405-eng-48)
(LBL-306) Avail: NTIS

X-ray photoelectron spectroscopy (XPS) has been used to obtain information concerning the structure and bonding in several biological and biologically related systems; it has also been shown to be useful for quantitative analysis of grain proteins. Correlations between charge and Fe3P and S2P electron binding energies have been established for a series of iron and sulfur compounds. These correlations, along with the XPS spectra of model iron-sulfur complexes have been used to help interpret the XPS spectra of the nonheme iron proteins. The resulting evidence supports postulated structures. In a similar manner the bonding and nature of the Prussian blue complexes were investigated. It was concluded that the Prussian blues are covalently bonded supercomplexes rather than ionic compounds. The nature of magnesium in chlorophyll found in photosynthetic membranes is also investigated. Author

N72-19104# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
THE DYNAMIC BIOMECHANICAL NATURE OF SPINAL FRACTURE AND ARTICULAR FACET DERANGEMENT Final Report
Leon E. Kazarian, Dale D. Boyd, and Henning E. vonGierke Aug. 1971 49 p refs
(AF Proj. 7231)
(AD-731148; AMRL-TR-71-17) Avail: NTIS CSCL 06/5

The application of appropriate scaling laws, animal experiments, particularly on primates, have been shown to be of value to explain hard tissue injury mechanisms and individual organ injury potential in man exposed to impact forces. In support of this approach rhesus monkeys were anesthetized, radiographed, positioned in an impact carriage, restrained by lap belt, torso harness, and limb retention straps, and exposed to -Gz seated rectangular acceleration time histories from predetermined drop heights. Shortly following impact all primates were radiographed, killed, and a necropsy performed. Attempts were made by means of an injury classification system to determine injury potential as a function of plateau acceleration and pulse duration for the spinal column. Type, frequency, and severity of vertebral body centrum fractures along with injury to the vertebral appendages were classified. Vertebral articular facets-apophyseal joints disorders and derangements proved difficult to identify radiographically due to poor X-ray film resolution, overlying soft tissue, and bony margin shadows. Necropsy demonstrated a large percentage of primates exhibited this type of lesion. Injury probabilities for the vertebral column established by radiographic and gross necropsy examination supplement and explain available knowledge on spinal injury mechanisms observed in the rhesus monkey. Applicability of these data to man will be discussed. Author (GRA)

N72-19105# School of Aerospace Medicine, Brooks AFB, Tex.
MEASUREMENT OF ELECTROMAGNETIC FIELDS WITHIN BULK MATERIALS BY MEANS OF THE MOESSBAUER

EFFECT Final Report, Mar. - Apr. 1970
John Taboada Apr. 1971 23 p refs
(AF Proj. 7757)
(AD-731119; SAM-TR-71-10) Avail: NTIS CSCL 06/18

The internal electromagnetic field of bulk objects being irradiated with radiofrequency (RF) radiation is often a necessary parameter for assessing potential radiation damage, particularly in the case of biologic entities. At present, most methods of measurement require some form of communication leads to an embedded probe; however, since these leads may serve as antennas, the local RF fields are frequently disturbed. Another approach could be the implantation of an intermediate frequency transmitter to telemeter the probe measurement. Excessive size makes such devices impractical. The shortcomings of the use of probes can be overcome by an application of the Mossbauer effect. Presented in this report are a description of the Mossbauer effect and how it can be applied to RF field measurement, a system design for establishing the Mossbauer effect experiment, and some preliminary results. Author (GRA)

N72-19106# School of Aerospace Medicine, Brooks AFB, Tex.
AEROMEDICAL REVIEWS: GRADES OF DECOMPRESSION SICKNESS IN UNPRESSURIZED AIRCRAFT
Thomas H. Allen Jun. 1971 26 p refs
(AD-731118; SAM-Review-4-71; SAM-TR-71-26) Avail: NTIS CSCL 06/19

The purpose of this study is to show with available evidence how to set forth the incidence of the several grades of bends that could arise, persist, and perhaps influence the success of sorties at altitudes above 20,000 ft. Author (GRA)

N72-19107# BioTechnology, Inc., Falls Church, Va.
EFFECTS OF 72-HOUR PARTIAL SLEEP DEPRIVATION HUMAN BEHAVIORAL AND PHYSIOLOGICAL RESPONSE MEASURES Final Report
Thomas W. Frazier (Walter Reed Army Inst. of Res.), Vernon A. Benignus (Behavioral Technol. Consultants, Inc.), Martin G. Every, and James F. Parker, Jr. Aug. 1971 50 p refs
(Contract DADA17-69-C-9010)
(AD-732872) Avail: NTIS CSCL 06/19

Ten adult males were subjected to partial sleep deprivation experiments in order to study the effects of progressive sleep deprivation on the basic biological rhythms underlying performance on signal detection tasks and to assess the value of using change in biological rhythms as an objective measure of human response to such types of stress. The data obtained were subjected to a power density spectral analysis with a program based upon the Fast Fourier Transform. The results show that signal detection measures, response latency, and heart rate are all highly sensitive in reflecting progressive loss of performance capability. Power spectral data also show changes as a function of sleep deprivation, indicating that one feature of this type of stress may be an alteration of basic human biorhythms.
Author (GRA)

N72-19108# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
DYNAMIC SEQUENTIAL PATTERN RECOGNITION APPLIED IN MEDICAL DIAGNOSIS
Eric Persoon Jul. 1971 87 p refs
(Grants AF-AFOSR-1776-69; NSF GK-18225; AF Proj. 9769)
(AD-734292; TR-EE71-24; AFOSR-71-3047TR) Avail: NTIS CSCL 06/5

In medical diagnosis the cost of the feature measurements is important. Therefore sequential classifiers which take in account the costs of the features have to be used. In the first part of the report methods are investigated to reduce the computations as much as possible. In the cases where still too much computation time is required, suboptimal procedures must be used. Data are available on patients with pancreas cancer, patients with liver cancer and healthy people. In the last chapter some comments are given about interaction of the physician with the algorithm and topics for further research are listed.
Author (GRA)

N72-19109# Texas Technological Univ., Lubbock. Center of Biotechnology and Human Performance.
AN ANNOTATED BIBLIOGRAPHY OF SELECTED WORKS IN AMBIGUITY AND ITS EFFECT ON DECISION MAKING
V. P. Luchsinger Dec. 1971 58 p refs
(Contract DAAD05-69-C-0102; DA Proj. 1T0-14501-B-81-A)
(AD-734348) Avail: NTIS CSCL 05/10

The bibliography represents the results of research efforts over several years. The chief thrust was to study the effects of ambiguity or uncertainty on the decision making behavior of humans operating individually or as groups. Author (GRA)

N72-19110# Cincinnati Univ., Ohio. Coll. of Medicine.
RADIATION EFFECTS IN MAN: MANIFESTATIONS AND THERAPEUTIC EFFORTS Annual Report, 1 May 1969 - 30 Apr. 1970
Eugene L. Saenger, Edward B. Silberstein, Bernard S. Aron, Harry Horwitz, James G. Kereiakes, I-Wen Chen, Carolyn Winget, and Goldine C. Gleser Dec. 1970 92 p refs
(Contract DASA01-69-C-0131; DASA Proj. NWER-XAXM)
(AD-732025; DASA-2599) Avail: NTIS CSCL 06/18

The goal of the program was to obtain new information regarding the pathophysiologic, psychologic, immunologic, hematologic, and biochemical effects of total- and partial-body irradiation in human beings. Irradiated patients all of whom have inoperable, metastatic carcinoma but are in relatively good health, provide the opportunity to study multiple facets of the effects of radiation in man rather than in experimental animal. The extrapolation of results from laboratory animals to man is fraught with error. Biochemical and psychological studies have extended the findings of previous report in depth and scope. Several new biological dosimeters are under evaluation.
Author (GRA)

N72-19111# Office of Naval Research, London (England).
BIOENERGETICS AND TEMPERATURE REGULATION SYMPOSIUM
Albert R. Dawe 20 Oct. 1971 12 p Symp. held at Dublin, 19-23 Jul. 1971
(AD-733401; ONRL-C-22-71) Avail: NTIS CSCL 06/16

Representatives of 23 countries attended this symposium concerned with bioenergetics and temperature regulation. The symposium was one of several 'satellite' symposia given both prior to and after the 25th International Physiological Congress held in Munich the following week. Author (GRA)

N72-19112# Arizona State Univ., Tempe.
VISUAL EVOKED POTENTIAL CHANGES IN HYPERBARIC ATMOSPHERES
Charles R. Larson, Dwight Sutton, Eugene M. Taylor, and Jerry D. Burns 1 Nov. 1971 17 p refs
(Contract N00014-68-A-0150; NR Proj. 196-077)
(AD-733416; TR-71-02) Avail: NTIS CSCL 06/19

The visual evoked potential (VEP) in chloralose-anesthetized cats decreased in amplitude as a function of increasing pressure. This was true for compression with pO2 = 200 or 1,000 mm Hg. Maintained pressure, while changing pO2 from 200 to 1,000 mm Hg or from 1,000 to 200, had little effect. If pO2 = 1,000 mm Hg was used in a session, variability in VEP measurements was extremely high, i.e., the VEP amplitude dropped to zero at 100 FSW for some cats, while other cats showed little effect at 500 FSW. Limited information on decompression indicates the VEP may be recovered from its depressed state at 500 FSW by slow decompression. Rapid decompression results in the VEP remaining depressed or being reduced in amplitude even further. The VEP was not a reliable index for determining decompression stops. Author (GRA)

N72-19113# Arizona State Univ., Tempe.
A CONCENTRATION-DEPENDENT ATTENUATION OF TOXIC OXYGEN EFFECTS IN THE MOUSE
Jerry D. Burns 15 Oct. 1971 14 p refs

(Contract N00014-68-A-0150; NR Proj. 196-077)
(AD-733418; TR-71-03) Avail: NTIS CSCL 06/19

Ninety male albino mice were exposed to 4, 6, or 8 atm oxygen partial pressure in 100%, 50%, or 25% dilutions. Tolerance was measured in terms of times to convulsion and times to death. Results indicated (a) both convulsion times and death times tended to increase with decreases in concentration, (b) the degree of change in tolerance as a function of concentration was greater for the low partial pressures, and (c) convulsion times and death times showed significant correlation only in the 4 atm partial pressure condition. The results further indicate a distinct decrease in susceptibility to toxic oxygen effects with increases in absolute pressure at fixed pO2.

Author (GRA)

N72-19114# University of Southern Calif., Los Angeles.
NEURAL ENCODING OF SENSORY INFORMATION Final Report, 1 Sep. 1969 - 31 Aug. 1970
Lewis G. Bishop Nov. 1971 5 p refs
(Grant AF-AFOSR-1869-70; AF Proj. 9777)
(AD-733421; AFOSR-71-2970TR) Avail: NTIS CSCL 06/16

Recordings of several directionally selective motion detectors were made in the optic lobe. Object wavelength and velocity relationships were determined and compared with optomotor response and it was concluded these neurons were part of the neural system underlying flight control. Spectral sensitivity measurements were then made on these units to determine how the system is organized to distinguish color. It was found that these units receive information from all described photopigments but do not distinguish color. Hence, the color channel and movement channel are separate which is surprising in the context of economy of neuron and in knowledge of neuroanatomy. Two papers have been published as a result of this research.

Author (GRA)

N72-19115# Brown Univ., Providence, R.I. Div. of Engineering.
ELASTIC ANALYSIS OF A SKULL
Claude H. Hardy and Pedro V. Marcel Nov. 1971 29 p refs
(Contract N00014-67-A-0191-0007; NR Proj. 064-512)
(AD-734176; TR-8) Avail: NTIS CSCL 06/2

A finite element elastic analysis is made of a skull. Measurements were made of the geometry and thickness of a skull. The skull was then idealized with a doubly curved and arbitrary triangular shell element. Results suggest that the skull is well built for resistance to front loads. The importance of using a composite material through the thickness of the shell was established. On the basis of tensile cracking at maximum elastic stress, loads of 3,500 lbs. and 1,400 lbs. were predicted for the first cracking of the skull due to front and side loading respectively.

Author (GRA)

N72-19116# Eye Research Foundation of Bethesda, Md.
THE STUDY OF RETINAL BURN: A METHOD FOR TRAINING AND MEASURING VISUAL ACUITY IN RHESUS MONKEYS Final Report, 1 Mar. 1969 - 30 Sep. 1971
David O. Robbins and Carl Richard Cavonius Nov. 1971 17 p refs
(Contract N00014-69-C-0240; NR Proj. 105-530)
(AD-733488) Avail: NTIS CSCL 06/16

A testing paradigm has been established to permit rapid and consistent measures of visual acuity in Rhesus monkeys. This method seems especially suited to studies requiring rapid measures of sensory function since the amount of time that elapses between the performance of the subject and the determination of the animal's acuity is minimal. The basic paradigm is a modification of the von Bekesy 'tracking' task in which the animal's task is to constantly adjust the stimulus value around his threshold level. Ten animals have been trained by this method and measures of their visual acuity ranged from 20/17 to 20/14, consistent with that of well corrected human.

Author (GRA)

N72-19117# Texas Technological Univ., Lubbock.
VIGILANCE AND MOTIVATION: A THEORETICAL NOTE
Peggy J. Blackwell and C. G. Halcomb 1970 16 p refs
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-733483) Avail: NTIS CSCL 05/10

A review suggests that the motivational aspects of performance have not been a central theoretical feature in vigilance and complex monitoring literature. Rather, the study of motivational variables has focused on task and environmental variables and, for the most part, has ignored motivational variables. A definition of motivation which is suitable for the context of vigilance and complex monitoring is presented, and theories which are centered about motivational aspects are reviewed. The authors suggest that an adaptation-level model of reinforcement may provide the necessary dynamic framework to promote systematic investigations of the complex monitoring problem.

GRA

N72-19118# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
IMPACT TOLERANCE: ABDOMINAL INJURY Final Report, 1 Jul. 1970 - 30 Jun. 1971
D. L. Beckman, J. H. McElhaney, V. L. Roberts, and R. L. Stalnaker 30 Jun. 1971 318 p refs
(Contract DOR-FH-11-7608)
(PB-204171; HSRI-71-102; DOT-HS-800-549) Avail: NTIS CSCL 13L

In order to provide data on human tolerance to blunt abdominal impact a literature study and laboratory tests were carried out to determine the major causes of abdominal injury, injury mechanisms, a quantitative relationship between input and occurrence of trauman and to develop the criteria to recommend performance requirements for materials which often produce blunt abdominal injury. An extensive analysis of case reports indicated that the most frequent causes of blunt abdominal injury were the steering wheel, seat belt and various protruding objects in a vehicle; the organs most often injured were the liver, pancreas, spleen and intestine.

Author (GRA)

N72-19138# Italian Air Force Aerospace Medical Center, Rome.
BEHAVIOUR OF SOME SERUM ENZYME ACTIVITIES IN MAN, AFTER CRASH ACCIDENTS, CAUSING MASSIVE INJURIES
G. Paolucci, G. Blundo, and A. Balla *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 5 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19140# Strathclyde Univ., Glasgow (Scotland). Bioengineering Unit.
THE MECHANICAL AND STRUCTURAL CHARACTERISTICS OF CONNECTIVE TISSUE
Bryan Finlay, John H. Evans, James F. North, Tom Gibson, and Robert M. Kenedi *In* AGARD Linear Acceleration of Impact Type 26 Feb. 1971 10 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19149# Hellenic Air Force General Hospital, Athens (Greece). Orthopaedic Dept.
SOME OBSERVATIONS ON COMPRESSION FRACTURES OF THE SPINE IN EJECTED GREEK PILOTS
Pan. P. Symeonides *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 3 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19387# Montana Univ., Missoula. Dept. of Botany.
EFFECTS OF AIR POLLUTION ON INDIGENOUS ANIMALS AND VEGETATION
C. C. Gordon *In* Environ. Protection Agency Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 95-112

refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

N72-19388# Environmental Protection Agency, Research Triangle Park, N.C. National Environmental Research Center.
EFFECTS OF AIR POLLUTION ON LIVESTOCK AND ANIMAL PRODUCTS
Trent R. Lewis *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 113-124 (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

N72-19389# Environmental Protection Agency, Research Triangle Park, N.C. National Environmental Research Center.
TRACE-METAL CONCENTRATIONS IN HUMAN HAIR
D. I. Hammer, J. F. Finklea, R. H. Hendricks, C. M. Shy, and R. J. N. Norton *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 125-134 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

N72-19390# Food and Drug Administration, Washington, D.C.
POSSIBLE HAZARDS ASSOCIATED WITH INGESTION OF GARDEN VEGETABLES CONTAMINATED BY TRACE METALS
Samuel I. Shibko *In* Environ. Protection Agency Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 135-144 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-19119# Advisory Group for Aerospace Research and Development, Paris (France).
LINEAR ACCELERATION OF IMPACT TYPE
26 Feb. 1971 466 p refs In ENGLISH and FRENCH Presented at the Aerospace Med. Panel Specialist Meeting, Oporto, Portugal, 23-26 Jun. 1971
(AGARD-CP-88-71) Avail: NTIS HC $6.00/MF $0.95

Recent aviation and automobile accidents are reviewed in an effort to reduce the human injury. The biodynamics, physiology, pathology, and clinical aspects of linear acceleration impact are discussed. For individual titles, see N72-19120 through N72-19163.

N72-19120# Royal Air Force, Farnborough (England).
TECHNICAL EVALUATION OF THE AEROSPACE MEDICAL PANEL SPECIALISTS MEETING ON LINEAR ACCELERATION (IMPACT TYPE)
D. H. Glaister *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 4 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Crash injury research is discussed, including biodynamics of impact, injury mechanisms and pathology, and techniques for impact attenuation. Impact forces related to seat ejection, facilities for impact studies, impact protection (restraint system), and head protection devices are considered. Recommendations for additional research are presented for crashworthiness, standardization, head and neck protection, ejection injury to the spine, and soft tissue injury mechanisms. J.A.M.

N72-19121# Army Aeromedical Research Lab., Fort Rucker, Ala.
SYMPOSIUM ON LINEAR ACCELERATION OF IMPACT TYPE INTRODUCTORY REMARKS
Edward J. Baldes *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 5 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Biodynamic and bioengineering applications to operational problems in the interface of man machine relationships are reviewed. Safety principles are discussed for reducing injuries. Data are presented on accidents in aircraft training programs and on highways. Author

N72-19122# Laboratoire UTAC, Montlhery (France).
ECONOMIC PROCEDURES FOR SIMULATING THE EFFECTS OF LINEAR COLLISIONS IN VIEW OF STUDIES OF RESTRAINING DEVICES FOR THE PROTECTION OF AUTOMOBILE OCCUPANTS [PROCEDES ECONOMIQUES PUR SIMULER LES EFFETS DE COLLISIONS LINEAIRES EN VUE DE L'ETUDE DES DISPOSITIES DE RETENUE OU DE LA PROTECTION DE OCCUPANTS D'UN VEHICULE AUTOMOBILE]
E. Chapoux and H. LeGuen *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 16 p In FRENCH (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

An apparatus was designed and perfected for collision studies, which involves stopping of passenger movement. The equipment described is being used in many European laboratories and provides many advantages at a minimal cost price.
Transl. by K.P.D.

N72-19123# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
AIRCRAFT ACCIDENT INJURIES AND AIRCRAFT ACCIDENT RECONSTRUCTION c02
S. Krefft *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 11 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The development and mechanics of injuries to aircraft passengers are examined. The reconstructive conclusions, with respect to the sequence of events, that can be drawn from the type, appearance, location, extent, and severity of the external and internal injuries sustained by the crash victims are discussed. Investigations are used to illustrate that owing to the injuries suffered in an aircraft accident the crash victims can bear silent witness and not only provide important clues but solid evidence permitting a reconstruction of the sequence of events. Author

N72-19124# Royal Air Force Inst. of Pathology and Tropical Medicine, Aylesbury (England).
HISTOPATHOLOGICAL RESPONSES TO DECELERATION
J. K. Mason *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 6 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Personal observations of 340 fatal aircraft accidents are used to study simple confirmation of lacerations to victims. The physical changes are described with reference to quantitation and differential diagnosis from natural disease. The significance of pulmonary tissue embolism is emphasized. Author

N72-19125# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
MAN'S SURVIVABILITY OF EXTREME FORCES IN FREE FALL IMPACT
Richard G. Snyder *In* AGARD Linear Acceleration of Impact

Type 26 Jun. 1971 13 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Exposure to extreme forces greater than experimentally tolerable were studied through human accidental or suicidal free-falls. Examples selected from nearly 30,000 free-fall cases illustrate the range of injury and fatality limits found under various conditions. Terminal velocity free-falls 53.64 m/sec (120 mph) without benefit of parachute were survived by Soviet, French, United Kingdom, and U.S. pilots and paratroopers under emergency ejection or evacuation conditions. Biophysical, biomechanical, and biomedical variables are discussed. Results indicate that there is a complex balance between factors of magnitude, calculated rate of onset and event duration, body axis orientation, force distribution, and properties of the impacted surface. Author

N72-19126# Association Peugeot-Renault, la Garenne-Colombes (France). Lab. de Physiologie et de Biomecanique.
COMPARISON OF THE EFFECTIVENESS OF TWO PASSIVE RESTRAINT SYSTEMS [EFFICACITE COMPAREE DE DEUX SYSTEMES DE RETENUE PASSIVE]
Claude Tarriere *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 13 p refs In FRENCH (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Safety belts are discussed in regard to the optimization of webbing rigidity and the utilization of shock absorbers at chest level. Performance level is compared to that of inflatable bags. Completely passive, automatic belts are considered. Experimental data are presented in terms of improving global efficacy, various highway accident types, and the cost/efficiency ratio.
Transl. by K.P.D.

N72-19127# National Institutes of Health, Bethesda, Md. National Inst. of Neurological Diseases and Stroke.
PROTECTION OF THE BRAIN FROM INJURY DURING IMPACT: EXPERIMENTAL STUDIES IN THE BIOMECHANICS OF HEAD INJURY
Ayub K. Ommaya and Arthur E. Hirsch (Natl. Highway Traffic Safety Admin.) *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 19 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Experimental data on head injury are summarized in three subhuman primate species undergoing controlled direct head impact and indirect impulsive head loading (whiplash). Testing of Holbourn's rotational hypothesis and the translation/cavitation hypothesis revealed discrepancies. Data are presented to show that a combination of heat rotation and skull distortion mechanisms are most injurious for brain damage during both direct and indirect impact. Current mathematical models with simultaneous experimental testing in development are reviewed. Author

N72-19128# Rochester Univ., N.Y. School of Medicine.
BIODYNAMICS OF SPORTS INJURIES
John D. States *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 6 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Helmets and restraint systems used in automobile racing, modified football shoe cleats, and release ski bindings have reduced the injury risks in these sports. Knowlege of human injury tolerance was gained through the study of sports accidents, particularly the determination of injury mechanisms. Injury tolerance data determined in the laboratory was also useful in designing sports safety equipment. Author

N72-19129# Army Board for Aviation Accident Research, Fort Rucker, Ala.
ANALYSIS OF US ARMY HELICOPTER ACCIDENTS TO DEFINE IMPACT INJURY PROBLEMS c02
Joseph L. Haley, Jr. *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 13 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

An overall view of the occupant injury experience in U.S. Army helicopters from January 1967 through December 1969 is presented. These data show that 40 percent of all occupant fatalities occurred in survivable accidents. This percentage shows the need for further improvement of helicopter crashworthiness. The statistics further indicated that fire was the single largest fatality cause with head injuries next in rank. A group of severe but survivable helicopter accidents of the same time period was studied. The study included three types of Army helicopters. Study results indicated that the problem of postcrash fire fatalities was more severe in the utility and cargo helicopters. It was also shown that potentially hazardous displacement of the transmission and main rotor blades occurred in one of every three utility and cargo helicopter accidents studied. Further, a roll about the long axis usually occurred. At least one roll occurred in 2 of 3 light observation helicopter accidents, 5 of 8 utility helicopter accidents, and 1 of 2 cargo helicopter accidents. The tendency to roll highlights the need to consider sideward occupant restraint and transmission/rotor blade moorings in these helicopters. Author

N72-19130# Birmingham Univ. (England). Dept. of Transportation.
AN ASSESSMENT OF ACTIVE AND PASSIVE RESTRAINTS IN SERIOUS INJURY EUROPEAN CAR OCCUPANT COLLISIONS
G. Murray Mackay *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 12 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

A field study of road accidents numbering 105 vehicles selected from the severe and fatal injury end of the injury spectrum are examined. The incidence of various crash configurations is outlined, together with the objects struck, and the rate with which the passenger compartment is penetrated. The relative frequencies of side impacts, and multiple and complex collisions are described. Each collision is examined in terms of the reduction in injuries to front seat occupants which might be obtained if an airbag was present. In a similar manner each collision is examined to assess the benefit if a lap/diagonal seat belt were worn. An overall judgement is therefore obtained on the relative benefits obtainable from airbags and belts. Belts are shown to be superior because they provide protection in a greater range of collision types. If a belt wear rate exceeding some 63% for drivers and 85% for front passengers were obtained then belts provide greater benefits than airbags. The importance of intrusion into the passenger compartment, especially in fatal collisions is emphasized as a restriction on restraint effectiveness in present day European car designs. Author

N72-19131# Naval Aerospace Medical Research Lab., New Orleans, La.
HUMAN DYNAMIC RESPONSE TO MINUS GX IMPACT ACCELERATION
Channing L. Ewing and Daniel J. Thomas *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 12 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The purposes of the study were fourfold: (1) to measure precisely the complete input acceleration to the head and neck measured at the first thoracic vertebra; (2) to measure precisely the dynamic response of the head and neck to the input acceleration; (3) to develop a method of obtaining the data in such a form that automatic data processing may be used; and (4) to develop and validate a general method for the experimental measurement of the bioengineering characteristics of the human body with such precision, accuracy, and repeatability that a mathematical model of the human dynamic response to impact acceleration can be constructed. Author

N72-19132# Naval Aerospace Medical Research Lab., New Orleans, La.
THEORETICAL MECHANICS FOR EXPRESSING IMPACT ACCELERATIVE RESPONSE OF HUMAN BEINGS

Daniel J. Thomas and Channing L. Ewing *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 7 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The theoretical requirements for expressing the kinematics of human impact acceleration experimentation are presented. Two basic coordinate systems for expression of the kinematic information are identified as: (1) the body reference frame, defined in terms of the experimental subject's anatomy; (2) the laboratory reference frame. A general set of rules for deriving these coordinate systems is described. Variables and parameters are defined in terms of the general set of rules. The resulting descriptions are compared with definitions for use in prolonged acceleration. Author

N72-19133# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamics and Bionics Div.
BIODYNAMIC MODELS AND THEIR APPLICATIONS
Henning E. vonGierke *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 18 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Progress in modeling the mechanical response of man exposed to various environmental forces is discussed. Starting with a mathematical description of the mechanical and physical characteristics of the integument, soft and hard tissue, the numerous approaches taken and the results obtained from modeling various integrated elements such as the human vertebral column under vibration and impact loads, the chest and respiratory system under vibratory and blast loads and of the whole body system for selected force input conditions and locations are reviewed. To derive a capability of modeling specific injury modes or experimentally observed probabilities of injury curves for various parenchymatous and hollow organs as a function of the force input variables, more detailed and specialized models are being used such as, for example, the lumped parameter, discrete parameter, and continuum model of the spine or models considering nonlinear tissue behavior. The status and value of these models for studying the body's physical and physiological response, for understanding and predicting injury mechanisms and probability of injury, for scaling the results of animal experiments, and for applying the models in protection engineering, such as escape and restraint systems design, are demonstrated. There is need for further experimental, as well as theoretical work, in support of these practical biomedical and hardware requirements. Author

N72-19134# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex.
THE BIODYNAMICS OF AIR BLAST
Clayton S. White, Robert K. Jones, Edward G. Damon, E. Royce Fletcher, and Donald R. Richmond *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 21 p refs Sponsored by DASA and AEC (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

After pointing out that accelerative and decelerative events are associated with the direct and indirect effects of exposure to blast-induced winds and pressure variations, some of the relevant biophysical parameters were selectively noted and discussed. These included the pressure-time relationship; species differences; ambient pressure effects; the significance of positional (orientational) and geometric (situational) factors as they influence the wave form, the pressure dose and the biologic response; and data bearing upon the etiology of blast injury. The consequences of pressure-induced violent implosion of the body wall and the significance of the associated variations in the internal gas and fluid pressures were described and emphasized, as were alternating phases of forced hemorrhage and arterial air embolization, fibrin thrombi, coagulation anomalies, and renal, cardiac and pulmonary sequelae. Tentative biomedical criteria consistent with recent interspecies scaling and modeling studies for assessing primary blast hazards were presented. Author

N72-19135# Department of Transportation, Washington, D.C. Natl. Highway Traffic Safety Administration.
LETHAL EFFECTS ON MAN OF UNDERWATER DETONATION OF A FIRECRACKER
Arthur E. Hirsch and Ayub K. Ommaya (NIH) *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 5 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

A firecracker exploded in contact with the skin within six inches of the skull base in a young man while he was swimming underwater. The resultant severe head injury and death appeared to be directly related to this underwater explosion. Reconstruction of the mechanics of this injury indicate that when the head is subjected to impact energies between 440 to 1800 in-lb and impact impulse between 1.8 to 3.5 lb.sec., both skull fracture and brain injury can occur. Author

N72-19136# Institutes fuer Wehrmedizin und Hygiene, Koblenz (West Germany).
HUMAN STRESS LOADS INDUCED THROUGH SIMULATED PRESSURES ON UNDERGROUND SHELTERS
G. Kleinhanss and H. Dupuis (Technischen Univ., Munich) *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 9 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Within the constraints of a simulated nuclear strike, the human stress loads to be expected were assessed through physical measurements taken on dummies placed in an underground shelter. Results verified that under the given conditions, exposure to shock would not cause detrimental effects to the health or a reduction in efficiency, due to physical factors, of operators manning control desks in the underground shelter. It is pointed out that results obtained on dummies may be applied analogously to man only to a limited extent, since no dummies showing human physiological and dynamic behavior were available. The assessment results apply only to the movement vectors observed during this test on shelter floor and walls. Conceivably, other vector variations may produce fundamentally different results. The measuring data related to three different seating arrangements indicate technical possibilities for shock reduction. Author

N72-19137# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioengineering and Evaluation Div.
PARACHUTING IMPACT INJURIES AT HIGH DROP ZONE ELEVATIONS: ENVIRONMENTAL EFFECTS
Stanley C. Knapp and George R. McCahan, Jr. *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 9 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

A review of parachuting injuries that are directly related to accelerative forces and impact is presented. The available and valid injury prediction statistics for a wide variety of parachuting activities is discussed. The environmental effects of wind shear, wind velocity, wind thermals, density altitude, terrain and topography, increased rates of descent, and temperature variations upon injury morbidity are analyzed. These effects were determined during experiments at 6,000 and 10,000 feet drop zone altitudes using the 32 feet parabolic-apex vented-static line deployed parachute. Injury rates were four times greater than those expected or experienced at sea level elevations. The conclusions and recommendations will be of practical value in the training and outfitting of parachutists for jumps into high elevation drop zones. Author

N72-19138# Italian Air Force Aerospace Medical Center, Rome.
BEHAVIOUR OF SOME SERUM ENZYME ACTIVITIES IN MAN, AFTER CRASH ACCIDENTS, CAUSING MASSIVE INJURIES c04
G. Paolucci, G. Blundo, and A. Balla *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 5 p refs (See N72-19119 10-05)

Avail: NTIS HC $6.00/MF $0.95

Observations were made of blood serum enzyme activities in an effort to verify the fact that such activity causes massive injuries and fractures to the human body. Several people involved in severe road accidents were observed for activities of the following enzymes: (1) Glutamic oxalacetic transaminase (GOT), (2) Glutamic pyruvic transaminase (GPT), (3) Lactate and Malate dehydrogenase (LDP, MHD), (4) Adalose (ALD), (5) Alkaline phosphates (ALKP), (6) Acid phosphate (AcP). Results show some enzyme activities increase in the most severely injured subjects and that a correlation exists between some enzyme activities and body damage. Results also indicate the possibility of evaluating the degree of body damage from certain enzyme activities and that some enzymes analyses, especially GOT, may be useful for diagnosis and medico-legal judgements. Author

N72-19139# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE DYNAMIC BIOMECHANICAL NATURE OF SPINAL FRACTURES AND ARTICULAR FACET DERANGEMENT
Leon E. Kazarian, Dale D. Boyd, and Henning E. vonGierke *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 25 p refs (See N72-19119 10-05)
(AMRL-TR-71-17) Avail: NTIS HC $6.00/MF $0.95

Through the application of appropriate scaling laws, animal experiments, particulary on primates, are shown to be of value in explaining hard tissue injury mechanisms and individual organ injury potential in man exposed to impact forces. In support of this approach rhesus monkeys were anesthetized, radiographed, positioned in an impact carriage, restrained by lap belt, torso harness, and limb retention straps, and exposed to +Gz seated rectangular acceleration time histories from predetermined drop heights. Shortly following impact all primates were radiographed, killed, and a necropsy performed. Attempts were made, by means of an injury classification system, to determine injury potential as a function of plateau acceleration and pulse duration for the spinal column. Type, frequency, and severity of vertebral body centrum fractures along with injury to the vertebral appendages were classified. Vertebral articular facets-apophyseal joints disorders and derangements proved difficult to identify radiographically due to poor X-ray film resolution, overlying soft tissue, and bony margin shadows. Necropsy demonstrated a large percentage of primates exhibited this type of lesion. Injury probabilites for the vertebral column established by radiographic and gross necropsy examination supplement and explain available knowledge on spinal injury mechanisms observed in the rhesus monkey. Author

N72-19140# Strathclyde Univ., Glasgow (Scotland). Bioengineering Unit.
THE MECHANICAL AND STRUCTURAL CHARACTERISTICS OF CONNECTIVE TISSUE c04
Bryan Finlay, John H. Evans, James F. North, Tom Gibson, and Robert M. Kenedi *In* AGARD Linear Acceleration of Impact Type 26 Feb. 1971 10 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

A range of test procedures is described in detail and typical data are given for human skin to illustrate the rate sensitive non-linearities that may be encountered with these materials. Criteria used to assess the 'failure' of a tissue are considered on the basis of impairment of physiological function. The normal structure of skin and its response to stress is illustrated by the use of the scanning electron microscope and the construction of a tendon model is described before finally assessing the whole process of tissue modelling. Author

N72-19141# Hughes Tool Co., Culver City, Calif. Aircraft Div.
DESIGNING HELICOPTERS FOR IMPROVED CRASH SURVIVABILITY c02
Henry G. Smith *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 14 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The fundamental theory for providing attenuation of the crash impact is reviewed, with emphasis upon understanding the relationship of the fundamental parameters of the problem. Based upon operating statistical data in regard to potentially survivable crashes, along with engineering studies of any new helicopter design, design objectives can be established for the level of crash protection to be provided for the occupants. In problems of this type, a tradeoff always exists between size and weight penalties incurred for crash survivability versus the value of that same amount of size or weight for performance, payload, armor, or armament. Methods of attenuating or absorbing the crash impact in a gradual manner are the key to the provision of high crash protection levels while imposing minimum weight penalties upon the helicopter. Operating experience confirms that improved helicopter crash survivability can actually be obtained in a military operational environment. In addition to the improvement of survivability, improved morale of the crew members was a side benefit. The current trends of crash protection for new helicopter designs are discussed with implications of further improvement from the crash survivability standpoint in future helicopters. Author

N72-19142# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
AUTOMOBILE STRUCTURAL CRASHWORTHINESS CONCEPTS FOR CRASH PROTECTION
Patrick M. Miller *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 16 p refs (See N72-19119 10-05)
(Contract DOT-FH-11-6918)
Avail: NTIS HC $6.00/MF $0.95

A series of full scale automobile crash tests were conducted to determine the structural crashworthiness performance of conventional automobiles and to evaluate the performance of structural concepts designed to provide protection during frontal and laterial impacts with fixed objects. Conditions believed to be representative of severe single vehicle accidents, where automobiles impact narrow obstacles, were developed and used in the study. The objectives of the structural modifications were to produce a more uniform energy absorption, i.e., more uniform decelerations near 40 g's and 20 g's, respectively, for frontal and lateral collisions. The frontal structural modifications considered both front and rear engine vehicle designs and were evaluated under impacts with a rigid pole barrier where the collision speeds ranged from 35 MPH to 63 MPH. These structural modifications were designed so that the entire distance in front of the passenger compartment could be used for energy absorption. The results demonstrated that the modifications when coupled with this restraint system provide for a force limiting system on the occupant for this range of impact conditions. Author

N72-19143# Wright Co., Kettering, Ohio.
ARMOR MATERIALS FOR LIFE SUPPORT
Robert Fred Rolsten, Joseph G. Dunleavy, and Edward G. Bodine *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 14 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

A historical review of armor personnnel protective devices is presented together with the philosophy of the use/disuse of armor. The current levels of protection, armor designs, and materials state-of-the-art are discussed. Author

N72-19144# Deputy Inspector General for Inspection and Safety (Air Force), Norton AFB, Calif.
OPERATIONAL ASPECTS OF FORCES ON MAN DURING EJECTION/EXTRACTION ESCAPE IN THE US AIR FORCE, 1 JANUARY 1968 - 31 DECEMBER 1970
Robert H. Shannon *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

A study of 468 ejections in the United States Air Force (USAF) reported during the period 1 January 1968 to December 1970 disclosed that one in nine crew members involved received major or fatal injuries as a result of forces encountered from

system initiation to parachute opening. In 49 cases the injuries received were classified as major (nonfatal), and three crew members were fatally injured. The majority of the major injuries were attributed to the initial forces of ejection and were primarily compression fractures of the vertebral column. These injuries continue to occur with consistent frequency in spite of the fact that the maximum accelerations of the catapults in use today are well below human tolerances. The major factors which influence the incidence of ejection force injuries are the type catapult used, ejection posture, and age of the individual involved. Of the three, ejection posture appears to be the single most critical factor. The correlation of the individual's weight, by type catapult, was not remarkable. The frequency of injuries attributed to Q-forces showed a significant increase over previous studies of USAF ejection escape experience. Although the incidence of high speed ejections has increased only slightly, Q-force injuries occurred in 4 percent of all nonfatal ejections and accounted for 12 percent of the total major injuries. Author

N72-19145# Loughborough Univ. of Technology (England). Dept. Ergonomics and Cybernetics.

MEASUREMENT OF HUMAN RESPONSES DURING IMPACT

J. Sandover *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 12 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

In response to a need for information on the dynamic properties of man when using ejection seats, equipment has been developed to simulate the transient acceleration of ejection. The equipment, and the data acquisition and processing systems, are described. The apparatus was used for mechanical impedance studies, and performs adequately up to 30 Hz. The present experimental program is designed to provide information on the variations of mechanical response of individual subjects, and between subjects, in a relatively restrictive experiment (e.g. hard seat, upright posture, low acceleration levels). The experiments so far, indicate the existence of a series resonance at 9 to 10 Hz. The use of mechanical impedance techniques leads to accurate measurement of mechanical response at the input to the body, but does not offer a great deal of evidence for the postulation of detailed models. For this reason, internal and external transmissibility measurements are advocated. Some preliminary transmissibility measurements are recorded. Considered of the literature, and the transmissibility measurements indicates deficiencies in many models of the body, and the need for a simple, direct approach. Author

N72-19146# Centre d'Essais en Vol, Bretigny-sur-Orge (France). Lab. de Medecine Aerospatiale.

EJECTION ACCELERATION: PHYSIOLOGICAL EFFECTS, TOLERANCE [ACCELERATIONS A L'EJECTION: MOYENS D'ETUDE: EFFETS PHYSIOLOGIQUES, TOLERANCE]

R. Auffret, H. Seris, J. Demange, and R. P. Delahaye *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 6 p refs In FRENCH (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The physiological effects of acceleration and ejection on man are studied with the aid of a centrifuge. Major efforts were made to establish human tolerance to different acceleration stresses and determine the occurence of lumbosacral spinal injuries, particularly intervertebral disks. The characteristics and performance of the centrifuge are included. Transl. by E.H.W.

N72-19147# Royal Aircraft Establishment, Farnborough (England). Human Engineering Div.

BLAST TESTING AIRCREW ESCAPE EQUIPMENT INCLUDING AN ACCOUNT OF A NEW TRANSONIC TEST FACILITY

J. M. Rayne *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The design of a facility and its performance in determining the effectiveness of aircrew equipment to air blasts up to Mach 1.3 are discussed. In this device the air speed decay profile is programmed and can be made to simulate a range of post ejection conditions from sea level to altitude. Tests on a protective helmet demonstrate that it will probably be practicable to give head protection up to about 700 kt at sea level. However, failures of the visor which have occurred, show that explosive disintegration of the whole helmet follows at air speeds from 600 kt upwards. Helmet and visor failures usually occur within 100 msec of exposure and the blast effect can be regarded as an impact. In testing helmets therefore, the total duration of exposure to severe blast does not appear to be important. On the other hand, fabric is destroyed by the effects of flutter and the extent of damage seems to be time dependent. Therefore, in testing fabric protective equipment the shape of the air flow decay curve may well be important. Author

N72-19148# Centre d'Essais en Vol, Bretigny-sur-Orge (France).

RADIOLOGICAL STUDY OF SPINAL INJURIES TO PILOTS UNDERGOING SUDDEN EJECTION [ETUDE RADIOLOGIQUE DES LESIONS DU RACHIS CHEZ LES PILOTES AYANT SUBI UNE EJECTION]

R. P. Delahaye, H. Seris, R. Auffret, G. Gueffier, and P. J. Metges *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p refs In FRENCH (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Spinal injuries to pilots, caused by sudden ejection, are studied radiologically. The study was made in an attempt to determine the exact traumatic injury, the vertebrae involved, the localization, and the type of fractures. The fractures caused by the propulsion of the ejection seat are also studied. It was determined that the ejection seat usually caused injuries to the 6th, 7th, and 8th vertebrae. It was also determined that the position of the pilot upon ejection contributes to spinal injuries.
Transl. by E.H.W.

N72-19149# Hellenic Air Force General Hospital, Athens (Greece). Orthopaedic Dept.

SOME OBSERVATIONS ON COMPRESSION FRACTURES OF THE SPINE IN EJECTED GREEK PILOTS c04

Pan. P. Symeonides *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 3 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The causes of compression fractures in Greek pilots during the decade 1960-1969 were investigated. Resumption of duties by pilots with such fractures was studied. It was found that 18 percent of the ejected pilots sustained compression fractures of the spine. All fractures occurred during ejection and were located at the dorsolumbar region of the spine (T10 to L3). There was sufficient evidence that excessive tightening of the ejection seat belts (shoulder-buttocks) produces a permanent flexion of the spine which thus becomes more vulnerable during ejection. If the wedging of a vertebra following a fracture does not exceed 1/3 of the height of the vertebral body and the symptoms are mild enough, the pilot may return to the active service as jet pilot. If wedging is greater than 1/3, he should not resume his previous duties either as jet or helicopter pilot because the created local kyphosis of the spine renders the neighboring vertebrae more vulnerable. Author

N72-19150# Civil Aeromedical Inst., Oklahoma City, Okla. Protection and Survival Lab.

DESIGN CONSIDERATIONS FOR IMPACT TEST FACILITIES c11

Richard F. Chandler *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 10 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

With the advent of World War 2 pilot shortage necessitated scientific investigation of the causes of crash injury. These early investigations made use of a variety of test facilities, including swing seats, acceleration towers, drop towers, acceleration tracks, and deceleration tracks. The facilities served as a basis for similar devices in use today. The purpose of these facilities is to produce a controlled impact representative of an actual crash.

Good simulation of the magnitude of acceleration changes is possible on these facilities, but none provide exact replication of the change in acceleration direction which is experienced in a crash. Author

N72-19151# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
A LINEAR DECELERATION TRACK c11
A. F. Giles *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 9 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The linear decelerator is housed in a building 52 m (170 ft) long and has a track length of 46 m (150 ft). The 545 kg (1200 lb) test vehicle is capable of carrying a payload of 160 kg (350 lb) and is propelled by rubber bungee ropes. It can attain a peak velocity of 23 metres/second (75 ft/sec). The arrester mechanism is capable of producing a peak vehicle deceleration of up to 50g and consists of a steel cable harness stretched across the track, each end being connected to the piston of a hydraulic cylinder. When the vehicle displaces the cables, movement of the pistons squeezes hydraulic fluid from each cylinder through a metered orifice, resulting in a controlled deceleration force on the vehicle. The profile shapes available are a half sine wave, a sine wave with a 50 millisecond plateau, a double peak, or a triple peak. Gravity onset rates can be varied from 60g/second to 750g/second. Author

N72-19152# Max-Planck-Institut fuer Arbeitsphysiologie, Dortmund (West Germany).
AN ELECTRO HYDRAULIC SYSTEM FOR SIMULATIONS OF COLLISIONS c11
W. Lange *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 4 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Equipment is described which is used in simulations of automobile collisions. The device consists mainly of a guided sled on which the cabin can be mounted forward, obliquely, laterally, or backward. The sled, which can be accelerated between 0 and 30 g, is piston powered and controlled by an electrohydraulic catapult. Mechanical, hydraulic and electrical design features as well as the recording system are described. Author

N72-19153# Fiat S.p.A., Turin (Italy).
FIAT CATAPULTS c11
E. Franchini *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

An outline is drawn of several propulsion systems adopted to launch a car against an obstacle and the reasons are given why the catapult system was preferred. This system allows the possibility of launching a car indoor; it is simple and of low cost and has a high operational flexibility. A description is given of the low and medium speed impact catapult and of the new catapult for collisions at up to 80 km/h of cars up to 2000 weight. The catapult design diagrams are given; The control and operation devices, and the measuring instrumentation, are described. The different types of test run with the catapult are illustrated. They include: (1) head-on collision against barrier at 90 degrees or at other angles of approach; (2) side impact against stationary car; (3) rear end collision; (4) wedging under stationary truck front, side or tail; (5) launching of car, raised clear of ground and placed transversally on the trolley, to simulate the side skidding impact against barrier or pole (6) sudden braking of a complete car to study the behavior of dummies in their impact against passenger compartment interior; (7) sudden braking of a dolly, on which a dummy is installed to study seat belts (or other restraint) or the impact of driver against steering wheel. Author

N72-19154# Motor Industry Research Association, Lindley (England).
THE MIRA VEHICLE IMPACT TEST FACILITY c11
T. R. Aston *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Tests were conducted out of doors initially, but with the introduction of legislation a large number of certification and compliance tests became necessary and, mainly because of the unpredictable climate in the U.K., it was found necessary to build an indoor test rig. On this test rig a linear induction motor is used as the prime mover and it is capable of accelerating vehicles of up to 10,000 lb. in weight to any speed up to 30 mph. Special provision was made for high speed cine photography and electronic instrumentation, and the entire test rig is automatically controlled. In order to safeguard personnel a comprehensive safety interlock system was incorporated. Author

N72-19155# National Bureau of Standards, Washington, D.C.
THE MATHEMATICS OF IMPACT, AND CRASH TESTS OF AIRPLANE AIRBAG RESTRAINT SYSTEMS
Carl C. Clark *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The r sub x, g sub y, and g sub z linear acceleration and r dot sub x, r dot sub y, and r dot sub z angular acceleration terminology (the latter representing radians/sec sq) is reviewed. It is urged that the representation of human acceleration environments by accelerometers be filtered to be flat (with less than 0.5 db variation) in response from 0 to 240 Hertz, and then attenuated above 240 Hz at 12 db per octave, in preference to the more common representation by ac accelerometers (flat from about 10 to 2000 Hertz). This latter representation often obscures biologically important accelerations in metal ringing spikes. Illustrations are drawn from crash studies of airplane airbag restraint systems and from mathematical representations of passenger compartment loads for automobile crashes of various types. Author

N72-19156# Michigan Univ., Ann Arbor.
BIOMECHANICS OF RESTRANT AND IMPACT ATTENUATION SYSTEMS
Verne L. Roberts and James H. McElhaney *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 9 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The methodology and results from research program concerning the protective aspects of passive restraint systems are provided. The criteria which should be used in the evaluation of passive restraints are provided and the experimental and analytical tools to define restraint performance are discussed. Research indicates that passive restraints can provide protection equal to that provided by belt systems and that a passive restraint must be carefully integrated with the vehicle interior to provide optimum protection. Author

N72-19157# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
RESTRAINT DESIGN: LABORATORY TEST AND EVALUATION OF OPERATIONAL EFFECTIVENESS
James W. Brinkley and John T. Shaffer *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 7 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Methods used to design contemporary personal flight equipment, such as restraint systems and ejection seat cushions, are presented. Emphasis is placed on the acceleration protection aspects of the design. Both analytical modeling and experimental determination of material characteristics are discussed. Experimental results of laboratory impact test evaluations of three items of personal equipment using human subjects are presented. These experiments include an evaluation of three operational restraint harnesses at -g sub x acceleration levels up to 15 g, a study of the acceleration transmission characteristics of ejection seat cushions, and work completed in the study of acceleration protection provided by rapidly deployed air bag

restraint systems. The implications of the experimental findings are discussed and related to operational experience. Author

N72-19158# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
A CASE FOR THE NEGATIVE-G STRAP
R. C. Reader *In* AGARD Linear Acceleration of Impact Type refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The addition of a negative-g strap is proposed in order to overcome some of the inadequacies of current restraint harnesses. The effects of aerobatics, vertical vibration, and crash impact on a harness are detailed, and the way in which the negative-g strap improves restraint is described. The advantages and disadvantages of negative-g straps in harnesses are discussed, and details of construction, location, and fitting are presented. Author

N72-19159# Max-Planck-Institut fuer Arbeitsphysiologie, Dortmund (West Germany).
SEVERE FRONTAL COLLISIONS AND RESULTING INJURIES WITH AND WITHOUT RESTRAINING DEVICES
W. Lange *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 10 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The results of simulated frontal collisions are briefly described. Types and magnitudes of injuries sustained by cadavers depended on (1) whether or not they were restrained by safety belts; (2) type and stiffness of belts; (3) absence or presence of steering assembly and instrument panel; and (4) interactions between body, harness and structures in the driver's space. Two pilot studies with air bags yielded conflicting results. Author

N72-19160# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
PROTECTION OF THE HEAD
J. A. Gillies *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 3 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

The protective helmets developed to ameliorate the effects of impact on the head improve survival and reduce injury in aircraft accidents. However they would be aided by improvements in restraint systems and better work space design. Aircrew protective helmets should continue to be designed to deal with high energy, rather than repetitive low energy, blows. The multiple functions of helmets make it difficult to meet all requirements without excessive size and weight. Reduction in both weight and size would be desirable, but current standards of protection should be maintained. The impact test method used in helmet development should take accident findings into account and should involve a small number of high energy blows. Author

N72-19161# Michigan Univ., Ann Arbor. Biomechanics Dept.
THE BIOMECHANICAL ASPECTS OF CRASH HELMET DESIGN
James H. McElhaney, Verne L. Roberts, and Richard L. Stalnaker *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

A head injury model capable of predicting head injury through a maximum strain criteria was developed. This model is coupled to a helmet model and the combination allows the prediction of optimum helmet performance characteristics within a given set of constraints including size and weight. Several model exercises consisting of varying coupling parameters are presented. It was concluded that helmet performance is improved by decreasing elastic stiffness and increasing damping properties. Author

N72-19162# M. L. Aviation Co., Ltd., Maidenhead (England).
THE DESIGN AND DEVELOPMENT TESTING OF AIRCREW PROTECTIVE HELMETS
J. Gregory *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 7 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

Problems of design resolution are discussed for effecting a compromise between conflicting requirements for flight helmets. There is the need to protect flight crew members from all possible consequences of a hostile environment, while allowing him to carry out his primary purpose of flying or operating the aircraft efficiently without hindrance from equipment. Stages of helmet design and component assembly testing are shown in sequences to indicate development, from initial shape/size conception and testing of individual components to full evaluation and testing of complete prototypes. Reference is made to the design development and testing of a general purpose military aircrew protective helmet/mask assembly nearing completion in the U.K. Particular attention was paid to keeping the all up weight of the assembly under 1800 g and, in addition to conventional helmet facilities, incorporating an automatically lowering visor for air blast protection. Author

N72-19163# Snell Memorial Foundation, Sacramento, Calif.
EVALUATION AND TESTING OF PROTECTIVE HEADGEAR
George G. Snively *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 7 p (See N72-19119 10-05)
(Grant EC-00013)
Avail: NTIS HC $6.00/MF $0.95

Review is made of factors which must be considered in evaluating the performance of protective headgear. Standards of performance are considered, and an analysis is presented of techniques utilized in helmet testing. Special attention is given to tests for penetration resistance, retention harness strength, and protection against impact. Author

N72-19164# Joint Publications Research Service, Arlington, Va.
STUDIES OF MAN-MACHINE RELATIONSHIPS
17 Feb. 1972 21 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 7, 1971 p 6-12
(JPRS-55216) Avail: NTIS

Man machine interactions and their optimizations are considered for operators working at keyboard devices of data collecting systems, monitors of industrial processes, and managerial personnel of information displays. For individual titles, see N72-19165 through N72-19167.

N72-19165# Joint Publications Research Service, Arlington, Va.
A STUDY OF OPERATOR'S WORK WITH DATA INPUT DEVICES
R. O. Yakerevich, R. S. Grayfer, and M. I. Abezgauz *In its* Studies in Man-Machine Relationships 17 Feb. 1972 p 1-6 refs (See N72-19164 10-05)
Avail: NTIS

Tests were made on operators working at keyboard devices of data collection and recording to determine the parameters characterizing the operator's performance in the data input regime, and also to investigate the effectiveness of different techniques of raising data reliability. Statistical distributions of mutual conversions of symbols found the highest probabilities of conversions characteristics for symbols lying side by side on the keyboard and also for symbols similar in shape. Use of a more complex full keyboard data input system ensured greater reliability compared with 10 key devices. Author

N72-19166# Joint Publications Research Service, Arlington, Va.
SELECTION OF OPERATIONAL CHECK POINTS
I. M. Panasenko *In its* Studies on Man-Machine Relationships 17 Feb. 1972 p 7-14 refs (See N72-19164 10-05)
Avail: NTIS

A working model is formulated for determining the minimum number of check points required for the human operator for

operational monitoring of an industrial process where the monitored parameters which characterize events that require intervention are regarded as operational check points. Graphs of the most indicative parameters interconnections which affect external influences are developed whose vertices are the working parameters of the installation, and whose arcs are the gain factors characterizing the variation of each successive parameters as a function of the preceding one. Knowing the gain factors of each influence on each parameter and by imposing external constraints that are associated with the correct installation operation, the single parameters necessary for operational monitoring are obtained. G.G.

N72-19167# Joint Publications Research Service, Arlington, Va.
INFORMATION DISPLAY METHOD IN DISCRETE-PRODUCTION AUTOMATIC CONTROL SYSTEMS
M. I. Abezgauz, Yu. A. Golant, Ye. P. Tereshko, and A. S. Grinberg *In its* Studies on Man-Machine Relationships 17 Feb. 1972 p 15-20 (See N72-19164 10-05)
Avail: NTIS

The organizational structure of a complex of documents that enables dispatcher personnel to conveniently use the documentation is considered. Codograms for an information resources scheme and the structure of documents for display are developed from interconnected events within the limits of competence for a given managerial worker, and also by the number of controlled events reflected by the given complex of documents. The final form-regulation report determines the makeup of the codograms which reflect the activities of other workers included in the group. G.G.

N72-19168*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
UNIVERSITY ROLE IN ASTRONAUT LIFE SUPPORT SYSTEMS: EXTRAVEHICULAR GUIDANCE AND STABILIZATION IN SPACE
Lonnie C. VonRenner Washington NASA Mar. 1972 73 p refs
(Grant NGR-22-009-312)
(NASA-CR-1919) Avail: NTIS CSCL 05E

Two problem areas are reviewed: (1) the nature of and approach to the EVA mission and (2) the guidance and stabilization required of such a mission. The report indicates several broad areas in which additional research is needed to provide an advance to the state-of-the-art. Moreover, the research problems cited were chosen from among many as those most amenable to research and study in the university environment. Author

N72-19169*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF SKYLAB EXPERIMENT T020 EMPLOYING A FOOT CONTROLLED MANEUVERING UNIT
Donald E. Hewes and Kenneth E. Glover Washington Mar. 1972 61 p refs
(NASA-TN-D-6674; L-8045) Avail: NTIS CSCL 05E

A review of the plans and preparations is presented for Skylab experiment T020, entitled Foot-Controlled Maneuvering Unit (FCMU). The FCMU is an experimental system intended to explore the use of simple astronaut maneuvering devices in the zero-gravity environment of space. This review also includes discussions of the FCMU concept and experiment hardware systems, as well as supporting experiment definition and development research studies conducted with the aid of zero-gravity simulators. Author

N72-19170*# Stanford Research Inst., Menlo Park, Calif.
EXPERIMENTAL STUDY OF VISUAL ACCOMMODATION
Tom N. Cornsweet and Hewitt D. Crane Washington NASA Mar. 1972 55 p refs
(Contract NAS2-5097)
(NASA-CR-2007) Avail: NTIS CSCL 16P

A summary report of a research effort related to the human visual accommodation system is presented. A theoretical study of the accommodation system was made. Subsequent effort was aimed at the development of specialized instrumentation for experiments designed to lead to understanding the nature of the control system in human accommodation. The necessary instrumentation consisted primarily of: (1) an automatic optometer to measure the state of eye focus, (2) a focus stimulator device to control the apparent optical distance to any target, and (3) a two-dimensional eye tracker. The concepts and designs of the first two instruments have been published in the open literature, but this report contains the first detailed treatment of the Purkinje eye tracker developed under this program. The report also discusses an accommodation lag model to explain the ability of the eye to apparently know the polarity of focus error even though the blur on the retina is to a first-approximation an even function. The interaction of the accommodation and eye movement systems is also discussed, as is the ability to train the visual accommodation system to a surprisingly responsive condition in only a few hours of training. Author

N72-19171*# Scientific Translation Service, Santa Barbara, Calif.
LIFE-SUPPORT SYSTEMS FOR INTERPLANETARY SPACECRAFT AND SPACE STATIONS OPERATING FOR A LONG PERIOD OF TIME
B. A. Adamovich Washington NASA Mar. 1972 71 p refs Transl. into ENGLISH from the book "Osnovy Kosmicheskoy Biologii i Meditsiny" Moscow, Acad. of Sci. USSR, 1970 p 1-70
(Contract NASw-2035)
(NASA-TT-F-14211) Avail: NTIS CSCL 06K

The selection and construction of life-support systems are discussed for prolonged space flights, based on regenerative physical-chemical systems. Particular methods of evaluating the reliability of these complex systems are noted. Details of a year-long sealed cabin experiment using regenerated water and oxygen are given. Author

N72-19172# Joint Publications Research Service, Arlington, Va.
ENGINEERING PSYCHOLOGY IN RADAR
G. P. Popov and V. I. Nikolayev, ed. 23 Mar. 1972 139 p refs Transl. into ENGLISH of the book "Inzhenernaya Psikhologiya V Radiolokatsii (Sistema Indikator-Operator)" Moscow, Sovetskoye Radio Publishing House, 1971 144 p
(JPRS-55522) Avail: NTIS

Problems of the application of engineering psychology data in the investigation and evaluation of the capabilities of circular-scanning radar sets (RLS) and of devices for representing information are considered. Special attention is devoted: to the statistical analysis of the process of detection of signals by the RLS operator; to a description of methods of calculating the characteristics of the detection of signals, with consideration of the psychophysiological features of the operator; and methods of finding optimum forms of communication in the indicator-operator link. The book is intended for the general circle of specialists interested in the designing and operation of indicator devices for RLS and devices for representing (displaying) information, as well as graduates and students specializing in the field of radar and automation of control. Author

N72-19173# BioTechnology, Inc., Falls Church, Va.
USE OF SPECTRAL ANALYSES IN THE STUDY OF HUMAN BEHAVIORAL AND PHYSIOLOGICAL RESPONSE MEASURES Final Report
Thomas W. Frazier (Walter Reed Army Inst. of Res.), Vita West, Martin G. Every, and James F. Parker, Jr. Jun. 1971 79 p refs
(Contract DADA17-69-C-9010)
(AD-732951) Avail: NTIS CSCL 05/10

In assessing changes in behavior, such as those found with sleep loss, the principal problem is one of measurement. The objective of the series of studies described in the report was to develop and validate a measurement and analysis technique for

examining human responses occurring through time. In the six studies reported, power spectra were computed for experimental data, along with coherence analyses and tests of significance. Behavioral results were compared with one another and with simultaneously recorded physiological data. The data from these studies indicate there are several rather stable biological rhythms, or oscillations, which occur in performance patterns. Several oscillations were identified in addition to the large (1.1 cycles/day) oscillation which corresponds to circadian rhythm. Oscillations of weaker intensities were found at 4.5, 9.0 (close to the work/rest cycle), and 18 cycles/day. The imposition of mild stress conditions was found, in many instances, to have a significant effect on the character of the basic biorhythms. It is felt that the use of time series data, in which rhythmicities in performance are identified and studied as the organism is exposed to unusual or stressful environments, represents a relatively new and potentially fruitful approach to behavioral research. Author (GRA)

N72-19174# Human Factors Research, Inc., Goleta, Calif.
DESIGN CHARACTERISTICS OF A GENERALIZED FIRE CONTROL SYSTEM MAINTENANCE TRAINER, GFCSMT Final Report, 1970 - 1971
John F. Depauli Sep. 1971 54 p
(Contract N61339-70-C-0249; VAVTRADEVCEN Proj. 8126-2)
(AD-733963; NAVTRADEVCEN-70-C-0249-1) Avail: NTIS CSCL 05/9

The purpose of investigation was to develop detailed design characteristics for a generalized fire-control system maintenance trainer (GFCSMT) to support training in basic maintenance and calibration of U.S. Navy underwater fire-control systems. The objective of the project was to refine the functional design characteristics presented in an earlier report and to establish an optimal physical configuration for the trainer. Perspective and plan-view drawings depicting various training features and trainer configurations were developed and used as the focal point for interviews with fire-control instructor personnel. The design presented in the report reflects a consensus of instructors and HFR personnel regarding the optimal physical configuration for a GFCSMT. GRA

N72-19175# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
PROTOCOL ANALYSIS AS A TASK FOR ARTIFICIAL INTELLIGENCE
Don A. Waterman and A. Newell 24 May 1971 31 p refs Submitted for publication
(Contract F44620-70-C-0107; Grant MH-07722; ARPA Order 827-6)
(AD-734286; CMU-CS-71-108; AFOSR-71-3071TR) Avail: NTIS CSCL 06/4

An attempt is being made to automate protocol analysis, which is a form of data analysis in psychology for inferring the information processes used by a human from his verbal behavior while solving a problem. The paper discusses protocol analysis as a task in artificial intelligence. The discussion is based on (but broader than) our current program, PAS-I, which creates a description of a subject's changing knowledge state from his verbal behavior. Author (GRA)

N72-19176# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biological Acoustics Branch.
EFFECTS OF NOISE ON SERIAL SEARCH PERFORMANCE Final Report, Oct. 1970 - Mar. 1971
C. Stanley Harris and George W. Filson Jul. 1971 34 p refs
(AF Proj. 7231)
(AD-731184; AMRL-TR-71-56) Avail: NTIS CSCL 05/10

To evaluate Broadbent's statements concerning the necessary conditions for demonstrating an adverse effect of noise on human performance, 70 subjects were tested on a serial search task. Performance was measured during broadband noise exposure at an overall level of 105 dB re 0.0002 dyne per square centimeter. The performance of one group of subjects was measured for 36 minutes with two 3-minute interpolated rest periods, while another group was tested for 36 consecutive minutes with no rest periods. The performance of these groups was compared with the performance of comparable control groups. In all groups, performance was measured for 5 days. Noise produced a statistically significant reduction in the number completed for the rest group for the first 12 minutes of testing on each day. There were no significant differences between the noise and control group during the last 24 minutes of testing. For the no rest groups, noise resulted in a smaller number of items completed on the last two days of testing and the difference was statistically significant. On these days the effect was constant throughout the 36 minutes of testing. These results are interpreted as generally supporting Broadbent's position. Author (GRA)

N72-19177# Texas Univ., Austin. Social Psychology Lab.
DIAGNOSIS AND PREDICTION: A STUDY OF DAILY BEHAVIOR PATTERNS IN TEKTITE 2
Roger Bakeman and Robert Helmreich Sep. 1971 48 p refs
(Contract N00014-67-A-0126-0001; NR Proj. 171-804)
(AD-733443; TR-17) Avail: NTIS CSCL 05/9

Systematic observations of daily behavior of 10 teams of Aquanauts living for a total of seven months in an underwater habitat are reported. Behavior was coded into objective categories by teams of observers monitoring activity 24 hours a day. Correlations between these categories for individual summary data are contrasted with the corresponding pooled within-class correlations. The latter are used here as a statistic measuring associative strength between time series variables both within and across individuals. The use of both Pearson and pooled correlations provides a more complete picture of daily behavioral patterns. Pooling correlations of lagged variables then allows exploration of causal linkages. Systematic observations and self-report measures are contrasted in their ability to account for variance in behavior. The potential application of this methodology to a variety of social psychological investigations is discussed. Author (GRA)

N72-19178# Battelle Memorial Inst., Columbus, Ohio.
CONSTRUCTION OF A PROTOTYPE FLEXIBLE RECOMPRESSION CHAMBER Task Report, Dec. 1969 - Mar. 1971
P. S. Riegel and J. S. Glasgow 3 Dec. 1971 23 p ref
(Contract N00014-70-C-0072)
(AD-733704) Avail: NTIS CSCL 06/12

Divers operating in remote locations are just as subject to decompression sickness as those working near well-equipped decompression facilities. It is for this reason that, over the years, a number of small, portable 1-man recompression chambers have been designed, built, and sold to the diving community. Because of the imperative need for fast treatment of decompression sickness, it is mandatory that an injured diver be gotten into compression just as soon as possible after he is injured. The objective of the task was to design and fabricate all of the necessary hardware associated with a non-man-rated, flexible recompression chamber, and to verify the feasibility of the concept. GRA

N72-19179# Air Force Human Resources Lab., Williams AFB, Ariz. Flying Training Div.
MULTI-MEDIA IN USAF PILOT TRAINING
Milton E. Wood Oct. 1971 15 p refs
(AF Proj. 1123)
(AD-732611; AFHRL-TR-71-14) Avail: NTIS CSCL 05/9

The flight-line portion of flying training has traditionally required large amounts of airborne practice under an apprenticeship form of instruction. New developments in educational technology, from both a philosophical and device point of view, provide new opportunities to train airborne skills in a ground environment. Through the use of multi-media instructional techniques, within the context of a systematic approach to training, much can be done to improve the overall efficiency of actual airborne practice. Author (GRA)

N72-19180# Bunker-Ramo Corp., Westlake Village, Calif. Human Factors Dept.
COMPARATIVE ANALYSIS OF HUMAN RELIABILITY Final Report
David Meister 30 Nov. 1971 583 p refs
(Contract N00024-71-C-1257)
(AD-734432; L0074-1U7) Avail: NTIS HC $6.00/MF $0.95 CSCL 05/8

The purpose of the study was to describe, analyze and compare available models and methods for making quantitative predictions of human performance in man-machine systems. The 22 methods reviewed were divided into those relating to operability and maintainability; operability models further subdivide into analytic (non-simulation) and simulation models. Each model was analyzed in terms of goals, assumptions, scope, parameters, data requirements, procedures and validation/application studies. The report provides requirements for development of input data banks and data presentation formats. The most recent studies and the state of the art of human reliability prediction are reviewed. Recommendations for further research are made, centering around a survey of user needs for predictive data. GRA

N72-19181# Franklin Inst., Philadelphia, Pa. Research Labs.
NON-NEWTONIAN FLOW FOR HUMAN IMPACT PROTECTION Final Report, 14 Dec. 1970 - 14 Sep. 1971
Francis Cooke, Georgina M. Overall, William B. Tarpley, Jr., and Roger C. May 16 Dec. 1971 40 p refs
(Contract N00156-71-C-0745)
(AD-734423; FIRL-F-C2976; NADC-CS-7124) Avail: NTIS CSCL 01/3

The energy absorption characteristics of a number of dilatant suspension systems were evaluated using a modified pendulum impact tester. Two systems which were found to have superior impact energy absorption properties are 50% corn starch - 2% SPAN 20 in a concentrated (26.5%) NaCl solution and 70.5% glass microbeads (29 mu) in water. The impact properties of all the dilatant systems were found to be significantly better than currently available ejection seat cushion materials. A qualitative correlation between the impact parameters measured in this investigation and the forces experienced during simulated ejection tests was made. GRA

N72-19182# Navy Clothing and Textile Research Unit, Natick, Mass.
PHYSIOLOGICAL EVALUATION OF A COMMERCIALLY AVAILABLE ABANDON-SHIP SURVIVAL SUIT
James C. Shampine and Dale A. Reins Nov. 1971 27 p refs
(AD-734136; TR-97; Rept-1-71) Avail: NTIS CSCL 06/17

Navy Clothing and Textile Research Unit (NCTRU) personnel have tested a commercially available abandon-ship survival suit in water at 35 F temperature, which is comparable to that found in various oceans throughout the world. Test results indicate that this suit will give protection from exposure to cold water for periods of 13 hours and more when worn over any of the ensembles studied during this test providing no other stresses are present which could influence the user's tolerance time. This suit can be donned quickly but cannot be worn over bulky cold-weather clothing. GRA

N72-19183# Uniroyal, Inc., Naugatuck, Conn.
LIGHTWEIGHT INSULATED FOOTWEAR Final Report, Jul. 1969 - Nov. 1971
R. A. Mazzeo Sep. 1971 88 p refs
(Contract DAAG17-70-C-0003; DA Proj. 1J6-62713-DJ-40)
(AD-734934; C/PLSEL-TR-72-9-CE) Avail: NTIS CSCL 15/5

Compound formulations having good low temperature flexibility were developed for the outsole, upper and outer skin of the lightweight insulated boot. The proper insulation thickness for the entire boot was determined from foot insulation test data to produce a boot having sufficient overall insulation. In an attempt to improve traction, a Vibram type outsole design was used. Susceptibility to puncture from ground objects was reduced by redesign of the outsole, and by spraying a thicker outer skin at the base of the boot. The ankle portion of the last was redesigned to provide a snugger fit and eliminate slippage at the heel while walking. A nylon sock lining to permit ease of donning and doffing was developed. Author (GRA)

N72-19184# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
COMPUTER PROGRAM FOR AN AIR BAG RESTRAINT SYSTEM Final Report, Jul. 1970 - Sep. 1971
Robert H. Dufort Sep. 1971 89 p
(Contract DOR-FH-11-7574; CAL Proj. YB-2985-V)
(PB-20417; CAL-YB-2985-V-2; DOT-HS-800-541) Avail: NTIS CSCL 13F

A simulation model was developed to provide an analytical tool for rapidly and inexpensively exploring the approximate performances of an air bag system. Acceleration and rebound of the impacting body are the principal measures of performance; how they are influenced by system design variations are the principal results. Typical design parameters which can be evaluated are inflation pressure, bag size, gross bag shape, vent area, vent actuation pressure as well as other system variables. The basic model air bag consists of a fabric type container having a cylindrical center section with hemispherical ends. A rigid body, corresponding to the size and weight of the torso of a vehicle occupant, is assumed to impact the air bag at the center and normal to the longitudinal axis. A deformed shape profile is postulated which maintains the longitudinal section periphery and the cross section contour lengths constant and equal to their initial values. All output parameters are provided as functions of time; these include acceleration, velocity, displacement, internal pressure, volume, pressure-force area, gas flow and residual gas weight. The report contains the equations and flow charts which describe the model. A program listing in BASIC + is presented as are examples for the solution of cylindrical and customized air bags. Author (GRA)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-19185*# Stanford Research Inst., Menlo Park, Calif.
LABORATORY CO2 PHOTOLYSIS STUDIES RELATED TO PLANETARY ATMOSPHERES Final Report, 1 Jan. 1971 - 14 Feb. 1972
Tom G. Slanger 10 Feb. 1972 34 p refs
(Contract NSR-05-019-252; SRI Proj. PAU-8162)
(NASA-CR-125684) Avail: NTIS CSCL 06A

The CO(a 3II) state, the upper state of the Cameron bands, was characterized with respect to its average radiative lifetime and its quenching coefficients for a series of simple molecules. The CO2 recombination reaction (O(3P) + CO + M yields CO2 + M) was studied as a function of temperature. For M = CO, the rate constant can be expressed as k = 6.5 x 10/33 exp(-4340 plus or minus 550/RT) cm to the 6th power molec/2 sec/1, whereas the rate for M = CO2, the pertinent species in the planetary atmospheres, is 1.6 times greater. The quantum yield for CO2 photodissociation was measured in the 1200-1500 A region, using atomic line sources. The yield throughout this spectral region was much lower than that measured at 1470 A, the lowest value obtained being 8% at 1304 A. Author

N72-19186# National Research Council of Canada, Ottawa (Ontario).
INVESTIGATIONS OF THE OVERVOLTAGE OF HYDROGEN: LEAD
L. P. Bicelli and C. Romagnani 1972 11 p refs Transl. into ENGLISH from Ric. Sci., Rend. A (Rome), vol. 8, no. 6, 1965

p 1345-1351
(NRC-TT-1525) Avail: NTIS

Hydrogen overvoltage on lead electrodes between 0.1 and 4000 A/sq m was investigated in sulfamic acid and in potassium and calcium sulfamate solutions. Results show that, increasing the current density, the measurements with solutions containing K(+) or Ca(2+) have at first absolute overvoltage values smaller and afterwards greater than those in acid solution. Increasing the current density even more, a value is reached at which the solutions containing K(+) or Ca(2+) show a sudden increase in the overvoltage value. Author

N72-19187*# Scientific Translation Service, Santa Barbara, Calif.

THE DETERMINATION OF Be, B, C, N, O, AND F BY ACTIVATION WITH p, d, He-3, AND ALPHA PARTICLE

Ch. Engelmann Washington NASA Mar. 1972 18 p refs Transl. into ENGLISH from J. Radioanal. Chem. (Amsterdam), v. 7, 1971 p 89-101
(Contract NASw-2035)
(NASA-TT-F-14202) Avail: NTIS CSCL 07B

The activation of these elements, homogeneously contained in a medium thicker than the path length and with slowing-down capacity close to that of aluminum, was determined as a function of energy by irradiating standards with p, d, He-3 and alpha particles for energies between; 5 and 15 MeV for protons, 5 and 20 MeV for deuterons and He-3 particles, 25 and 42 MeV for alpha particles. The detection sensitivities are deduced from the curves obtained. The results apply to all materials through a simple relationship which takes the path lengths into account. They may be used to foresee the possibilities offered by activation with these charged particles when the samples to be analyzed are irradiated with a beam of given intensity and energy lying between the above limits. Author

N72-19188# Royal Aircraft Establishment, Farnborough (England).

EFFECT OF THE TEMPERATURE OF DISSOLUTION ON THE PROPERTIES OF POLYVINYLCHLORIDE SPINNING SOLUTIONS

V. D. Fichman, V. M. Alekseeva, V. Z. Volkov, and G. U. Vinogradov Sep. 1971 25 p refs Transl. into ENGLISH from Faserforsch. Textiltech. (East Germany), v. 22, no. 1, 1971 p 9-16
(RAE-Lib-Trans-1592; BR-28059) Avail: NTIS

The rheological properties of polyvinylchloride spinning solutions in dimethyiformamide were investigated as a function of the temperature of solution. Increasing the temperature of solution results in low viscosity over wide ranges of stress and deformation rates due to a reduction in the size of the supramolecular particles of the solution. This enables more stretching to be done during fiber spinning both from the spinneret and during the hot stretching stage. Consequently higher solution temperatures result in fibers with higher strengths and more resistance to bending fatigue. Author

N72-19189*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEVELOPABLE IMAGES PRODUCED BY X-RAYS USING THE NICKEL-HYPOPHOSPHITE SYSTEM. 2: EXPOSURE AND DEVELOPMENT PARAMETERS FOR SODIUM HYPOPHOSPHITE

Charles E. May, Warren H. Philipp, and Stanley J. Marsik Washington Mar. 1972 13 p refs
(NASA-TN-D-6743; E-6747) Avail: NTIS CSCL 17D

Crystalline sodium hypophosphite was X-irradiated and then treated with an ammoniacal nickel hypophosphite solution. Treatment resulted in the precipitation of nickel metal. The yield of nickel metal varied directly with particle size, sample weight, X-ray voltage, target current, exposure time, and development time. These findings show the process to be potentially useful in X-ray type photography. The half-life for the latent image species was found to be relatively short; but this is not critical in most X-ray photography applications. Furthermore, the work can be interpreted on the basis that a hydrogen atom is involved in the mechanism and indicates that the autocatalytic development step may be self-poisoning. Author

N72-19190# Royal Aircraft Establishment, Farnborough (England).

POLY (1,3-PHENYLENE HEXAFLUORO TRIMETHYLENE)

V. C. R. McLoughlin, J. Thrower, Patricia A. Grattan, and M. A. H. Hewins May 1971 36 p refs
(RAE-TR-71111) Avail: NTIS

Two routes involving fluoro alkyl copper intermediates were used to prepare poly (1,3-phenylene hexafluoro trimethylene): by the reaction of 1-iodo 3-(m-iodo phenyl) hexafluoro propane and an excess of copper, and by the reaction of stoichiometric amounts of 1,3-di iodo hexafluoro propane and 1,3-di (m-iodo phenyl) hexafluoro propane with an excess of copper, both reactions being done in polar aprotic solvents. The preparation of the intermediate iodo compounds are described. Poly (1,3-phenylene hexafluoro trimethylene) was obtained in low molecular weight form (inherent viscosity up to 0.11 dl/g), because of termination reactions involving the solvents. The polymer is a brittle resin which becomes elastomeric at 30 to 35 C, and is quite thermally stable: extensive weight loss does not occur below 450 C in air or in nitrogen. ESRO

N72-19191# Gulf Radiation Technology, San Diego, Calif.

ELECTRONIC AND IONIC REACTIONS IN ATMOSPHERIC GASES Yearly Technical Summary Report, 1 Sep. 1970 - 30 Jun. 1971

R. H. Neynaber, J. A. Rutherford, and D. A. Vroom 28 Jul. 1971 72 p refs
(Contract DASA01-69-C-0044; Gulf Proj. RT-6103)
(AD-734110; Gulf-RT-A10767; DNA-2753F) Avail: NTIS CSCL 07/4

Laboratory measurements indicate that the metastable ions of O(-) in reaction with N2 in the low-energy range (14 eV) react to form principally N2(-), while the ion molecule reaction to form NO(-) has a very small probability. The ground-state O(-) reacts mainly to form NO(-). The abundance of metastable O(-2)D ions was determined using the observation that O(-2)D - N2 has a small cross section for forming NO(-). The ion-energy dependences for both reactions were measured within the energy range 1.0 to 500 eV. Author (GRA)

N72-19192# Houston Univ., Tex. Dept. of Mechanical Engineering.

THE INFLUENCE OF SURFACE ACTIVE CONTAMINATION ON THE INTERACTION BETWEEN WIND AND WAVES

John C. Scott and D. Muster Oct. 1971 110 p refs
(Contract N00014-68-A-0402-0003; NR Proj. 185-602)
(AD-734159; TR-27) Avail: NTIS CSCL 07/4

The well-known effect of the use of oil to reduce the wave disturbance on a water surface is examined starting from a historical viewpoint, and the considerable uncertainty about the mechanisms involved is emphasized. Using a moire fringe observation technique, the wind-induced disturbance of water surfaces was monitored. Some disturbance was measured over the whole range of wind velocity, no evidence of a 'critical' velocity being found. Turbulent mixing of the surface layers was found when the surface response reached a certain level.
Author (GRA)

N72-19193# Air Force Academy, Colo. Frank J. Seiler Research Lab.

THE STRUCTURE OF ALUMINUM CHLORIDE SODIUM CHLORIDE MELTS

Armand A. Fannin, Jr., Lowell A. King, and David W. Seegmiller Oct. 1971 42 p refs
(AF Proj. 7903)
(AD-734714; SRL-TR-71-0018) Avail: NTIS CSCL 07/4

Aluminum-chlorine formation cells utilizing molten mixtures

of AlCl3 and NaCl as the electrolyte are being investigated for use as high energy density batteries. An essential part of the program has been the determination of the activities of the aluminum species in the electrolyte. Equilibrium constants were calculated for reactions governing the species present at 175 C in molten mixtures of aluminum chloride and sodium chloride. The equilibria postulated pertain to formation of the complex ions AlCl4(-), Al2Cl7(-), and Al3Cl10(-) from Cl(-), AlCl3, and Al2Cl6. The constants were derived from potentials exhibited by concentration cells of the type Al/AlCl3(N), NaCl//AlCl3(N), NaCl/Al, and from vapor pressures over pure AlCl3 and molten AlCl3-NaCl mixtures. Measurements were made throughout the concentration range N - 0.498 to N - 0.71. Author (GRA)

N72-19194# Battelle Memorial Inst., Columbus, Ohio.
PREPARATION AND PROPERTIES OF RARE-EARTH COMPOUNDS Semiannual Technical Report, 4 Jun. 1971 - 3 Jan. 1972
Van E. Wood, Kenneth C. Brog, Alfred E. Austin, James F. Miller, William H. Jones, Jr., Edward W. Collings, and Ronald D. Baxter 4 Jan. 1972 46 p refs
(Contract DAAH01-70-C-1076; ARPA Order 1588)
(AD-735120) Avail: NTIS CSCL 20/12

Preparation, characterization, and physical properties of rare-earth compounds of technological potential are described. Work was in the areas of magnetoferroelectric materials and of narrow-band narrow-gap semiconductors. In the former area, the primary objective was to develop a simultaneously ferroelectric and ferromagnetic device element operating in a useful temperature range. Solid solutions of rare-earth manganites, chromites, and ferrites have been the main object of investigation. Narrow-band narrow-gap semiconductors undergoing purely electronic semiconductor-to-metal transitions are of considerable practical and fundamental interest. The transitions investigated were the pressure-induced ones in the Sm chalcogenides. Work is continuing on solid solutions of similar composition. Some of these materials display strong white cathodoluminescence. Author (GRA)

N72-19195# Florida Univ., Gainesville. Dept. of Physics and Astronomy.
COLLISION DYNAMICS IN PLASMAS Final Report, Sep. 1963 - Sep. 1971
T. L. Bailey and B. S. Thomas Dec. 1971 16 p refs
(Grant AF-AFOSR-1353-68; AF Proj. 9767)
(AD-734795; AFOSR-72-0003TR) Avail: NTIS CSCL 07/4

The work has made significant contributions to the field of atomic collision physics. It has been concerned principally with: The energetics and dynamics of inelastic and reactive collisions; Investigations of the forces between ions and atoms by means of differential scattering experiments. Most earlier experimental work on ionic collisions has consisted of total cross-section measurements. Such studies were, and are, of great value, but taken by themselves are rather limited as to the information which they give concerning the detailed nature of the collisions studied. The research of this project has, in contrast, emphasized 'collision dynamics,' as given by measurements of the distributions in angle and/or kinetic energy of the collision products.
Author (GRA)

N72-19196# Western Michigan Univ., Kalamazoo. Dept. of Chemistry.
RATES AND MECHANISMS OF REACTIONS OF FLUORINE CONTAINING ROCKET PROPELLANTS Final Scientific Report, 1 Jun. 1967 - 31 Aug. 1971
Thomas Houser 31 Aug. 1971 51 p refs
(Grant AF-AFOSR-1291-67; AF Proj. 9750)
(AD-734796; AFOSR-71-2993TR) Avail: NTIS CSCL 07/4

The primary objective of the study is to obtain a better understanding of the chemical properties of fluorine containing rocket propellants. The compounds selected for study were OF2 and N2F4 because their chemical properties have not been well established. The rate and mechanism of pyrolysis of OF2 has been studied over the temperature range of 330 to 431 C, and a concentration range of one to ten mole % OF2 in helium at a total pressure of one atmosphere. The only observed products were oxygen and fluorine. The rate of the hydrogen-oxygen difluoride reaction has been studied over the temperature range of 110-260 C. Attempts have been made to obtain rate data for the hydrogentetrafluorohydrazine reaction. It was found that steady-state reaction could not be achieved using only He as the diluent. GRA

N72-19197# Army Electronics Command, Fort Monmouth, N.J.
EMISSION SPECTROSCOPY: A STUDY OF ELECTRODE MATERIALS AND DESIGNS
James W. Mellichamp Nov. 1971 32 p refs
(DA Proj. 1T0-61102-B-13-A)
(AD-734817; ECOM-3501) Avail: NTIS CSCL 07/4

An important consideration for optimum analytical results by emission spectroscopy is the electrode material and the designs into which they are shaped. In atomic excitation by the dc arc, the entry rate of the sample into the arc column is determined by these factors plus the arc current, thus affecting both sensitivity and reproducibility of results. In all excitation methods (dc arc, ac arc, spark, etc.) the quality of the electrode material and dimensional consistency of electrodes are crucial to discharge stability and repeatability of results. Graphite in several of its many forms is used as the electrode material almost to the exclusion of other possible materials because of its unique properties. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-19198 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATIVE DISTORTION POWER IN THE TRANSMISSION OF PULSE-CODE MODULATED SIGNALS (DATA) OVER HOMOGENEOUS WAVEGUIDES
H. L. Hartmann 5 Jan. 1972 22 p refs Transl. into ENGLISH from Arch. Elek. Uebertrag. (Stuttgart), v. 21, no. 4, 1967 p 181-189
(NLL-Trans-2804-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

In transmitting preferably stochastic, pulse-code modulated signals (data) over homogeneous long-hand waveguides the resultant signal distortion makes itself felt as carrier-frequency dispersion noise. The ratio of mean distortion power to signal power (relative distortion power) is calculated from the transmission constants of the guide. Its dependence on the half-amplitude width of the pulses, carrier frequency, and line length is presented. Simple methods are devised for measuring the relative distortion power before and after demodulation. Results of first distortion measurements on an experimental long-haul waveguide are communicated. Author

N72-19199 National Lending Library for Science and Technology, Boston Spa (England).
POSSIBILITIES OF DIGITAL ENCODING AND TRANSMISSION OF COLOUR TELEVISION SIGNALS
L. Stenger and G. Wengenroth 5 Jan. 1972 12 p refs Transl. into ENGLISH from NTZ-Nachr. Tech. Z. (Brunswick), v. 24, no. 6, Jun. 1971 p 312-325
(NLL-Trans-2810-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The possibilities of PCM encoding of a color television signal and its insertion in the system hierarchy of a future PCM

communication network are discussed. The technique of encoding the complete color signal is compared with that of a separate encoding of luminance and chrominance components. Here the latter proves to be superior with regard to economy in frequency bandwidth and to its adaptability to a hierarchical PCM system. Various possible solutions are indicated for the time division multiplexing of the luminance signal and the chrominance signal. Author

N72-19200 National Lending Library for Science and Technology, Boston Spa (England).
DISTORTION OF PULSE CODE MODULATED SIGNALS IN TRANSMISSION OVER AN EXPERIMENTAL WAVEGUIDE SECTION OF DIELECTRICALLY LINED ALUMINIUM TUBES
H. L. Hartmann 5 Jan. 1972 4 p refs Transl. into ENGLISH from Frequenz (West Berlin), v. 21, no. 3, 1967 p 99-100
(NLL-Trans-2817-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Signal distortion due to mode conversion was calculated from the measured variations of attenuation characteristics and was also determined directly from the contour distortion of the PCM signal. Both approaches led to the same result. A theoretical extrapolation was carried out for longer paths having the length of a repeater section. By bringing mode filters into the guide, the transmission conditions can be approximately met in the frequency range stated above. Author

N72-19201*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
COMMUNICATION SYSTEM MODELING
L. D. Holland, J. R. Walsh, and R. D. Wetherington 19 Nov. 1971 163 p refs
(Contract NAS8-20054; Proj. A-852)
(NASA-CR-122554; TR-9) Avail: NTIS CSCL 17B

This report presents the results of work on communications systems modeling and covers three different areas of modeling. The first of these deals with the modeling of signals in communication systems in the frequency domain and the calculation of spectra for various modulations. These techniques are applied in determining the frequency spectra produced by a unified carrier system, the down-link portion of the Command and Communications System (CCS). The second modeling area covers the modeling of portions of a communication system on a block basis. A detailed analysis and modeling effort based on control theory is presented along with its application to modeling of the automatic frequency control system of an FM transmitter. A third topic discussed is a method for approximate modeling of stiff systems using state variable techniques. Author

N72-19202*# Radiation, Inc., Melbourne, Fla.
STUDY OF STATISTICAL CODING FOR DIGITAL TV Final Report
Lawrence W. Gardenhire Jan. 1972 67 p refs
(Contract NAS9-11749)
(NASA-CR-115458) Avail: NTIS CSCL 17B

The results are presented for a detailed study to determine a pseudo-optimum statistical code to be installed in a digital TV demonstration test set. Studies of source encoding were undertaken, using redundancy removal techniques in which the picture is reproduced within a preset tolerance. A method of source encoding, which preliminary studies show to be encouraging, is statistical encoding. A pseudo-optimum code was defined and the associated performance of the code was determined. The format was fixed at 525 lines per frame, 30 frames per second, as per commercial standards. Author

N72-19203# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
MEASUREMENT AND REGISTRATION OF RAPID NONRECURRENT PROGRESSIVE PROCESSES WITH MECHANICAL RECORDERS Ph.D. Thesis [MESSUNG UND REGISTRIERUNG RASCHER, EINMALIGABLAUFENDER VORGAENGE MIT MECHANISCHEN SCHREIBERN]
Franz Freyberger 15 Feb. 1971 21 p refs In GERMAN
Avail: NTIS

An electronic controlled analog scanning-printing device for automatic measurement and registration of dynamic linear processes is described. The apparatus encorporates an input amplifier with logarithmic characteristics for the registration of noise values, and a controlled scanning frequency generator that adjusts scanning frequency to the variations in the registration process. A frequency control system registers frequency shifts and corrects the generator so that a filtration effect is produced and optimal use of the storage elements is assured. Transl. by G.G.

N72-19204# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik
COMPARISON OF CODES FOR TRANSFERRING DIGITAL SIGNALS IN REGENERATIVE CHANNELS Ph.D. Thesis [VERGLEICH VON CODES FUER DIE UEBERTRAGUNG DIGITALER SIGNALE IN REGENERATIVEN KANAELEN]
Ulrich Appel 22 Jul. 1971 157 p refs In GERMAN
Avail: NTIS

General properties of transfer codes are outlined and eight codes for a transfer channel with inserted regenerators are considered. Since the regenerators are nonlinear, at each pulse point it is decided to which delivered coding symbol the received signal corresponds, and this signal is again transmitted by the regenerator. The number of errors in regeneration depends on the selected code as well as on the properties of the transmitter channel. It is shown that the transmission properties of the various codes depend mainly on the transient behavior of the coding symbols at the receiving filter of the regenerator. Transient behavior diagrams of undisturbed code signals and noise amplitude distribution are used to calculate the error probability in the transmission and to formulate corresponding binary and ternary codes. Transl. by G.G.

N72-19205*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTROSTATIC-PROBE MEASUREMENTS OF PLASMA PARAMETERS FOR TWO REENTRY FLIGHT EXPERIMENTS AT 25000 FEET PER SECOND
W. Linwood Jones, Jr. and Aubrey E. Cross Washington Feb. 1972 131 p refs
(NASA-TN-D-6617; L-7984) Avail: NTIS CSCL 20I

Unique plasma diagnostic measurements at high altitudes from two geometrically similar blunt body reentry spacecraft using electrostatic probe rakes are presented. The probes measured the positive ion density profiles (shape and magnitude) during the two flights. The probe measurements were made at eight discrete points (1 cm to 7 cm) from the vehicle surface in the aft flow field of the spacecraft over the altitude range of 85.3 to 53.3 km (280,000 to 175,000 ft) with measured densities of 10 to the 8th power to 10 to the 12th power electrons/cu cm, respectively. Maximum reentry velocity for each spacecraft was approximately 7620 meters/second (25,000 ft/sec). In the first flight experiment, water was periodically injected into a flow field which was contaminated by ablation products from the spacecraft nose region. The nonablative nose of the second spacecraft thereby minimized flow field contamination. Comparisons of the probe measured density profiles with theoretical calculations are presented with discussion as to the probable cause of significant disagreement. Also discussed are the correlation of probe measurements with vehicle angle of attack motions and the good high altitude agreement between electron densities inferred from the probe measurements, VHF antenna measurements, and microwave reflectometer diagnostic measurements. Author

N72-19206*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SMS/GOES WEFAX USERS GUIDE
Jan. 1972 12 p refs

(NASA-TM-X-65853; X-490-72-84) Avail: NTIS CSCL 17B

An attempt is made to provide both the WEFAX user and the APT user with the basic equipments necessary to convert present equipment to the new SMS WEFAX frequency. This conversion is simple and, as in all communication systems, can be accomplished by innumerable approaches. The approach used here assumed commercial purchase of components and integration by the user into his system. This conversion requires no modification to existing equipment and is simply an RF conversion from S-band to the present VHF frequencies. Author

N72-19207*# Martin Marietta Corp., Baltimore, Md.
ANTENNA FEEDS AND RECEIVERS Interim Report, Apr. - Nov. 1971
Ben McCall Feb. 1972 155 p
(Contract NAS5-21615)
(NASA-CR-122365; OR-11660-1) Avail: NTIS CSCL 17B

The results of 7 months of study, tradeoffs, test design, and fabrication are presented for an effort to modify three ground stations in support of the ATS-F program. As a result of tests on the existing feed system of the Rosman No. 2 85-foot antenna and on the transportable ground station (TGS) 40-foot antenna, it was determined that modifications of the existing phase-compensating rotary joints at Rosman are feasible. Other components must be completely replaced. In the TGS antenna feed system, it was found to be feasible to broadband the existing monopulse comparator by adding simple irises and posts; both spare and active comparators were modified. The TGS polarizers can be broadbanded by adjusting existing pins and adding two new pins. These modifications are also directly applicable to the Mojave 40-foot antenna. Detailed electrical and mechanical characteristics are presented for the new equipment, as well as installation plans to enable NASA and its contractors to determine the adequacy of the designs and to confirm that planned locations are both available and compatible with planned operational concepts. Author

N72-19208# Joint Publications Research Service, Arlington, Va.
CALCULATION OF DIRECTIVITY CHARACTERISTICS OF EQUIANGULAR CONICAL DOUBLE-SPIRAL ANTENNAS
N. P. Timirev and V. S. Zadvornov 9 Mar. 1972 17 p refs Transl. into ENGLISH from Antenny (Moscow), no. 11, 1971 p 60-73
(JPRS-55394) Avail: NTIS

The radiation field of a conical equiangular double-spiral antenna is determined. In solving the problem it is assumed that directivity characteristics of an antenna are formed by a certain region the boundaries of which are determined on the basis of analysis of expression for the radiation vector created by different sections of the spiral. Expressions for an engineering calculation of the antenna's radiation patterns and experimental results confirm the calculated data. Author.

N72-19209# Helsinki Univ. (Finland).
OPTICAL COMMUNICATION THEORY
Seppo J. Halme 1971 19 p refs Presented at the Meeting of the Centre Intern. d'Inform. Sci. et Tech., Paris, 1-3 Dec. 1971
(Rept-S-43-1971) Avail: NTIS

A short review of quantum field representations is given. The motivation and basic idea of optimum reception is discussed. Cases such as a known coherent signal in or without noise, Gaussian or lognormal incoherent signals in thermal noise are analyzed and the results are interpreted. These results are extended to more familiar suboptimal receivers such as energy detectors and heterodyne devices. Author (ESRO)

N72-19210# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
EFFECTS ON DESIGN, DEVELOPMENT AND OPERATION OF A COMMUNICATION SATELLITE (CEPT MISSION) USING SPACE SHUTTLE AND TUG Final report
Nov. 1971 58 p Prepared for ESRO
(Contract ESTEC-1403-71-EL)
(MBB-UR-V-46; ESRO-CR-(P)-72) Avail: NTIS

The design of the CEPT communication satellites utilizing telephones and television is studied by evaluating the implications of using space shuttles/tugs for placement, repair on ground, and repair in orbit as opposed to the Europa 3 launch vehicle. Cost requirements are examined, and it is concluded that the satellite would best be launched by the shuttle/tug. ESRO

N72-19211# Kiruna Geophysical Observatory (Sweden).
POLARIZATION MEASUREMENTS OF FREQUENCY STABILIZED VLF SIGNALS
Johnny Svennesson Dec. 1971 35 p refs
(KGO-716) Avail: NTIS

A strong effect of induced secondary fields at the measuring site on the roof of the observatory building is observed. A source of secondary fields consisting of an inductive loop is found, which well describes the observed anomalies both in magnitude and phase. From continuous polarization measurements it is concluded that there is no diurnal variation in the polarization parameters although the parameters are less variable when the receiver site is in sunlight. No correlation is observed between ionospheric events and changes in the polarization parameters. A higher degree of polarization by a factor of approximately 3 is observed for east-west propagation compared to west-east propagation. Author (ESRO)

N72-19212# TRW Systems Group, Redondo Beach, Calif.
ERROR CORRECTION/MULTIPLEX FOR MEGABIT DATA CHANNELS. VOLUME 1: ANALYSIS Final Technical Report
G. Solomon and D. J. Spencer Griffiss AFB, N. Y. RADC Sep. 1971 171 p refs See also Vol. 2, N72-19213
(Contract F30602-70-C-0160)
(AD-731567; TRW-7353.4-038-Vol-1; RADC-TR-71-176-Vol-1) Avail: NTIS CSCL 09/4

The complete logical design of a coder/multiplexer system containing a fully automatic multiplex and code synchronization scheme with no bandwidth penalty has been carried out. This volume gives the analyses involved in selecting the implemented technique. It describes in detail many innovative coding features considered in the design. Author (GRA)

N72-19213# TRW Systems Group, Redondo Beach, Calif.
ERROR CORRECTION/MULTIPLEX FOR MEGABIT DATA CHANNELS. VOLUME 2: IMPLEMENTATION Final Technical Report
G. Solomon and D. J. Spencer Griffiss AFB, N. Y. RADC Sep. 1971 270 p refs See also Vol. 1, N72-19212
(Contract F30602-70-C-0160)
(AD-731568; TRW-7353.4-039-Vol-2; RADC-TR-71-176-Vol-2) Avail: NTIS CSCL 09/4

The complete logical design of a coder/multiplexer system containing a fully automatic multiplex and code synchronization scheme with no bandwidth penalty has been carried out. Volume I gives the analyses involved in selecting the implemented technique. It describes in detail many innovative coding features considered in the design. This volume presents the resultant final design. Author (GRA)

N72-19214# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DESCRIPTIVE REPRESENTATIONS OF REMOTELY SENSED IMAGE DATA
O. Firschein and M. A. Fischler May 1971 36 p refs
(Contract N00014-70-C-0239)
(AD-734013; FMSC-6-83-71-5) Avail: NTIS CSCL 05/2

The paper deals with natural language descriptions of image data - words, phrases, or sentences which attempt to capture aspects of the content or 'meaning' of an image. Such an investigation has application to artificial intelligence, linguistic analysis, and retrieval. With respect to the topic of retrieval, the

concept of an 'encyclopedic entry' for an image is considered, a representation complete enough to be used in place of the image to answer questions concerning the image. Topics such as canonical forms for descriptions, and methods of combining forms to obtain composite descriptions are discussed, using descriptions obtained from recent earth resources documents.
Author (GRA)

N72-19215# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
THE DETECTION OF RANDOMLY OCCURRING EVENTS WITH RANDOM DURATIONS
Richard M. Heitmeyer Nov. 1971 35 p
(Contract N00014-67-A-0181-0032)
(AD-734026; TR-214; Rept-036040-8-T) Avail: NTIS CSCL 09/4

The report considers the detection of events whose occurrence times and durations are random variables. In this context, two special cases are considered: The continuous-action detectors that seek to respond at each time when an event is present; and the discrete-action detectors that seek to respond at only a single time during which each event is present. For both cases, the optimum detectors are specified in terms of recursion relations and examples of the numerical solutions of these relations are presented and compared. Author (GRA)

N72-19216# California Univ., Los Angeles. School of Engineering and Applied Science.
THE ELLIPTICAL CYLINDRICAL LIQUID LENS
C. Yeh Oct. 1971 33 p refs
(Contract N00014-69-A-0200-4026)
(AD-734016; UCLA-ENG-7164) Avail: NTIS CSCL 20/1

The problem of the focusing of pressure wave by a thick elliptical cylinder liquid lens has been treated in a rigorous manner. The size of the lens is of the order of or slightly greater than the wavelength of the incoming acoustic signal. Detailed computation has been carried out for a representative case in which a liquid lens with index of refraction of 1.8 and density of 1900 kg/cubic meter is assumed to be immersed in sea water. It is shown that a slight deformation of the boundary surface of a circular liquid lens results in significant changes in the location of the focal region and that elliptical lens may provide stronger focusing than an equivalent circular lens. This research also points out the necessity pursuing an investigation on thin lenses where the focal regions are located outside the lenses.
Author (GRA)

N72-19217# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTENNAS FOR RADIO COMMUNICATION, BROADCASTING, AND TELEVISION
G. Z. Ayzenberg and S. P. Belousov 4 Nov. 1971 34 p refs Transl. into ENGLISH from the book "Antenny i Antennye Ustroistva. Sbornik Statei" 1970 p 40-57
(AD-734224; FTD-HT-23-285-71) Avail: NTIS CSCL 09/5

The article represents a general discussion of various types of antennas for radio communication, radio and television broadcasting, and space communication. The uses and advantages of various antennas are pointed out and antenna parameters are given in many cases. GRA

N72-19218# Maryland Univ., College Park. Dept. of Electrical Engineering.
NETWORK DESIGN WITH TOLERANCE: INTERVAL ANALYSIS APPROACH
P. Bodharamik and R. Newcomb Dec. 1971 6 p refs
(Grants AF-AFOSR-1910-70; NSF GK-24036; AF Proj. 9749)
(AD-734285; AFOSR-71-3072TR) Avail: NTIS CSCL 09/5

The use of interval analysis in network design is outlined with particular reference to its use in design with elements having tolerances. An example illustrates the results.
Author (GRA)

N72-19219# Connecticut Univ., Storrs.
SPECIFIC PHONEME INTELLIGIBILITY OF WORDS SUBJECTED TO TIME-SMEARING DISTORTION Interim Report
Russell L. Sergent (Naval Submarine Med. Center), Joseph S. Russotti (Naval Submarine Med. Center), and Harry S. Cooker 25 Jan. 1971 16 p refs
(Contract N00014-67-A-0197-0001)
(AD-734123; NSMRL-649) Avail: NTIS CSCL 17/2

One distortion to speech transmitted through the ocean is known as 'time-smearing'. A detailed analysis was made of the intelligibility of spoken consonants in time-smeared speech. Recorded tests of speech materials were treated by computer to simulate varied degrees of time-smearing. In addition, the speech was further degraded by either 4000 or 1200 Hertz low-pass filtering. The responses of 320 sailors who heard this material were analyzed for phoneme intelligibility. Results show the reduction in intelligibility produced by changing the filter condition was much greater than reductions caused by altering smear duration. As the duration of the smearing increased, intelligibility dropped significantly. Author (GRA)

N72-19220# Connecticut Univ., Storrs.
INTERSUBMARINE SPEECH INTELLIGIBILITY LEVELS Interim Report
Thomas Murry (Naval Submarine Med. Center) and Christine Strand 8 Mar. 1971 14 p refs
(Contract N00014-67-A-0197-0001)
(AD-734127) Avail: NTIS CSCL 17/2

The purpose of the investigation was to determine levels of speech intelligibility between two submarines using standard transmitting and receiving units while in operation. Transmission and reception of prerecorded and live voice word lists was made using an AN/WQC-2 sonar unit with directional and omnidirectional transducer arrays. The lists were recorded at the point of reception and played back to listeners for an evaluation of the speech intelligibility. The results indicate that the intelligibility scores were highest when reception was directional and both the transmitter and receiver were at the same depth. The live voice tests showed slightly higher intelligibility scores than the prerecorded lists. It would appear that further tests on reception mode incorporating such variables as range, depth, and speed of the ships are necessary to generalize to more operating conditions than those tested in the study. Author (GRA)

N72-19221# Naval Ordnance Lab., White Oak, Md.
CALCULATION OF THE MINIUM DETECTABLE SIGNAL FOR PRACTICAL SPECTRUM ANALYZERS
C. Nicholas Pryor 2 Aug. 1971 61 p refs
(AD-734379; NOLTR-71-92) Avail: NTIS CSCL 09/4

Spectrum analyzers are commonly used in random signal analysis to locate discrete sine wave components in a broadband noise background. The report describes a procedure for determining the sensitivity of practical spectrum analyzers for this task. The minimum detectable signal level for an idealized system is first computed and then adjusted to account for deviations from ideal behavior in a practical system. It is felt that the result allows prediction of sensitivity within about 0.5 decibels. Author (GRA)

N72-19222# Army Electronics Command, Fort Monmouth, N.J.
ACTIVE FILTERS APPLIED TO HELICOPTER NOISE REDUCTION
Richard S. Tilton Jul. 1971 28 p refs
(DA Proj. 1H6-62705-A-057)
(AD-734812; ECOM-3454) Avail: NTIS CSCL 09/5

Two active filter resonators of the negative feed-back type are evaluated. Claimed stability in literature and design formulas are verified by an active filter breadboard. Requirements for a passive L-C filter, developed for avionics equipment, were used as design objectives. The desired response was realized using two resonator types. A hybrid version of the active filter was designed and fabricated to establish that microminiaturization was feasible without any degradation in performance.
Author (GRA)

N72-19223# Naval Scientific and Technical Information Centre, Orpington (England).
ON CAMERAS FOR COLOURED TELEVISION
K. Vambera Sep. 1971 15 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), v. 15, no. 2, Feb. 1971 p 46-52
(AD-734513; NSTIC-Trans-2521) Avail: NTIS CSCL 17/2

The aim of the work is to gather fundamental observations on new trends in the development of a new television camera for colour television. The questions considered were based on the possibility of using one transmitting tube for the formation of two colour signals. The use in the optical path of band filters, and possibly the illumination of part of the target, is proposed as a coding arrangement. The methods are based on time, amplitude and frequency-separated colour components of the signal. Author (GRA)

N72-19224# Admiralty Research Lab., Teddington (England).
GENERAL TREATMENT OF MODULATION SCANNING
G. M. Voglis Feb. 1970 49 p refs
(AD-734429; ARL/H/R3; NSTIC-27406) Avail: NTIS CSCL 17/1

The basic principles of scanning sonars employing modulation scanning are described. Using elementary matrix theory a number of methods involving frequency change are evolved including a multistage system of particular relevance to rapid scanning of fine beams over wide sectors. Phasing requirements and limitations due to carrier frequency are examined.
Author (GRA)

N72-19225# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLVING THE INNER AND OUTER PROBLEM OF A FERRITE ANTENNA
D. Cernohorsky 18 Oct. 1971 18 p Transl. into ENGLISH from Slaboproudy Obzor (Prague), v. 31, no. 4, 1970 p 172-177
(AF Proj. 4367)
(AD-734883; FTD-HC-23-863-71) Avail: NTIS CSCL 09/5

The article describes one possible solution of the radiation and input impedance problems of a ferrite antenna. The stated method of solution is not entirely general and exact, but it allows a more general view at the working of a ferrite antenna. GRA

N72-19226# Speech Communications Research Lab., Inc., Santa Barbara, Calif.
FORMANT TRAJECTORY ESTIMATION FROM A LINEAR LEAST-SQUARES INVERSE FILTER FORMULATION
John D. Markel Oct. 1971 186 p refs
(Contract N00014-67-C-0118; NR Proj. 049-122)
(AD-734679; SCRL-Monograph-T) Avail: NTIS CSCL 17/2

The purpose of the document is to develop in some detail a new method for accurately estimating formant trajectories from voiced speech. Given a segment or frame of speech data, an inverse filter is designed such that the input signal is transformed into a best estimate of white noise. By constraining the filter length, an estimate of the smooth resonance structure of the input signal is obtained from the resulting inverse filter spectrum. The peaks of this spectrum define the raw data for the frame being analyzed. Based upon all of the raw data for the utterance it is generally a trivial task to define the first three and sometimes four formant trajectories by inspection. Efficient computational techniques, and considerations in the application of the inverse filter are discussed in detail. Fortran programs for implementing the inverse filter are presented as appendices.
Author (GRA)

N72-19227# Mitre Corp., Bedford, Mass.
CHARACTERIZATION AND MEASUREMENT OF DISPERSIVE CHANNELS
John L. Ramsey Nov. 1971 67 p refs
(Contract F19628-71-C-0002; AF Proj. 511A)
(AD-734751; MTR-2184) Avail: NTIS CSCL 09/4

The report is concerned with the characterization and study of dispersive channels. It shows how and why the physical channel distorts signals, it presents an experimental program for acquiring data to characterize the channel, and it indicates how the experimental data could be used either to evaluate the performance of arbitrary signaling techniques or to design effective signals for communicating over the channel.
Author (GRA)

N72-19228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERKOMAT TELECOMMUNICATIONS SYSTEM
K. Ulrich 3 Nov. 1971 9 p refs Transl. into ENGLISH from Avtomat., Telemekh. Svyaz (USSR), no. 4, 1969 p 3
(Contract F33657-71-C-0142)
(AD-734910; FTD-HT-23-1490-71) Avail: NTIS CSCL 17/2

The article tells of the 'Interkomat' universal telephone communications system, developed by the RFT industrial association of East Germany with the participation of other socialist countries. The 'Interkomat' is an overall system which includes microwave systems, VHF radio-telephone mobile units, PBX exchanges, secretarial telephone equipment, and which can be expanded to provide a global communications capability.
Author (GRA)

N72-19229# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UHF PROPAGATION. STUDY RESULTS AND FUTURE RESEARCH TRENDS
A. I. Kalinin 4 Nov. 1971 15 p refs Transl. into ENGLISH from the publ. "Voprosy Sovremennoj Svyazi, Sbornik Statei" Moscow, Svyaz, 1970 p 23-28
(Contract F33657-71-C-0142)
(AD-734911; FTD-HT-23-283-71) Avail: NTIS CSCL 17/2

The author attempted to assess the principal results of a variety of UHF propagation studies (in such areas as line-of-sight microwave communication links, tropospheric-scatter radio-relay circuits, satellite communication channels, etc.) and to outline the future research directions essential to the development and advancement of wide-band radio communication and broadcasting systems. GRA

N72-19230# Ohio State Univ., Columbus. Electroscience Lab.
ADAPTIVE ANTENNA ARRAYS FOR AIRCRAFT COMMUNICATION SYSTEMS Final Report, 15 Feb. - 15 Aug. 1971
R. T. Compton, Jr. Jan. 1972 126 p refs
(Contract N00014-67-A-0232-0009)
(AD-735096; ESL-3098-2) Avail: NTIS CSCL 09/5

The primary purpose of the work is to investigate the use of adaptive array techniques for obtaining scannable patterns from arrays on curved surfaces. The report describes the antenna patterns obtained with an experimental adaptive array on an aircraft fuselage mockup. The antenna system consisted of four flush-mounted multiturn loop elements tunable over the 200-400 MHZ band. Patterns were taken on this adaptive antenna system for a variety of frequencies, element locations, surface configurations, and for numerous angles of arrival of the desired signal. Author (GRA)

N72-19231# RAND Corp., Santa Monica, Calif.
CENTRAL LIMIT THEOREMS FOR CONDITIONALLY LINEAR RANDOM PROCESSES
Percy A. Pierre Jun. 1971 31 p refs
(AD-735071; P-4650) Avail: NTIS CSCL 17/9

The work reported in the paper is part of Rand's broad studies of radar signal-processing methods. Models of radar clutter interference are developed which are both physically reasonable and more general than the usual Gaussian model or linear-process model. These are called conditionally linear processes. The major contribution of this paper is the development

of simple conditions under which linear functionals of data generated by the model will have a Gaussian distribution. The result enables the computation of detection probabilities and false alarms for linear signal detectors. Author (GRA)

N72-19232# Naval Postgraduate School, Monterey, Calif.
A LOW COST SINGLE SIDEBAND MULTIPLEX SYSTEM M.S. Thesis
Guy Robert Knieriem Sep. 1971 54 p refs
(AD-734969) Avail: NTIS CSCL 17/2

A thirty channel low cost single sideband multiplex system is presented. This design is specifically tailored for microwave communications by small businesses desiring inexpensive, high quality communication links. One channel was built and tested in the laboratory and the results are included. A major factor in the low cost of this system without compromising performance was the availability of inexpensive mechanical filters. Synchronization is a major feature of this system using injected carrier to maintain phase-lock. Author (GRA)

N72-19233# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE PRINCIPLE AXIS COORDINATE SYSTEM APPLIED TO DIFFRACTION OF ELECTROMAGNETIC RADIATION BY WEAK SONIC VIBRATIONS IN AN ANISOTROPIC MEDIUM
Michael F. Baran Oct. 1971 111 p refs
(AF Proj. 5710)
(AD-734753; DS/PH/71-7) Avail: NTIS CSCL 20/14

It is well established that under certain general assumptions concerning an anisotropic medium, the constitutive relations associated with Maxwell's equations may be represented as a linear effective permittivity tensor. When electron collisions may be treated with a single effective collision frequency, this tensor is normal, and leads to a basis for a complex mathematical three-space related to the anisotropy of the medium. Maxwell's equations are defined in this system, and by use of the general contravariant and covariant tensor formalisms, the necessary dual coordinate bases and vector relations are established eliminating the need for ad hoc assumptions used by previous authors. The principal modes of propagation in the medium are then easily found and the classic Appleton-Hartree equation is derived. A necessary condition for the existence of solutions to propagation problems is developed. An original solution to the diffraction of a transverse (to the static field) electromagnetic wave by a transverse sonic variation in an anisotropic half-space is obtained, limited only by the Bragg condition. Author (GRA)

N72-19498# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
SATELLITE TELEVISION SYSTEM
O. Hofmann *In* AGARD Avionics in Spacecraft Sep. 1971 11 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19504# Standard Electrik Lorenz A. G., Stuttgart (West Germany).
PROGRAMMABLE PCM TELEMETRY ENCODER FOR SPACE APPLICATIONS
D. Pabst *In* AGARD Avionics in Spacecraft Sep. 1971 4 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19506# IBM Italia, Rome.
AN APPROACH TO NATURAL LANGUAGE FOR COMMAND AND CONTROL SYSTEMS
A. Lanzara *In* AGARD Avionics in Spacecraft Sep. 1971 9 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19507# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A VARIABLE COVERAGE SATELLITE ANTENNA SYSTEM
A. R. Dion and L. J. Ricardi *In* AGARD Avionics in Spacecraft Sep. 1971 13 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19508# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DESIGN OF TELEMETRY AND TELECOMMAND LINKS FOR INTERPLANETARY SPACE PROBES
E. Stolle *In* AGARD Avionics in Spacecraft Sep. 1971 16 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19509# Royal Aircraft Establishment, Farnborough (England).
SOME ASPECTS OF MULTIPATH FADING IN AERONAUTICAL SATELLITE SYSTEMS
M. J. Sidford *In* AGARD Avionics in Spacecraft Sep. 1971 15 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19510# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
RANGING TRANSPONDERS FOR INTERPLANETARY SPACE PROBES
H. Bassenberg and R. Stoiber *In* AGARD Avionics in Spacecraft Sep. 1971 12 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19511# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFICIENT X-BAND POWER GENERATION FOR SATELLITE COMMUNICATIONS
D. M. Snider *In* AGARD Avionics in Spacecraft Sep. 1971 9 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19512# Royal Aircraft Establishment, Farnborough (England).
MEASUREMENT OF ANTENNA RADIATION PATTERNS ON SPACECRAFT
A. Stembridge *In* AGARD Avionics in Spacecraft Sep. 1971 11 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19514# Royal Aircraft Establishment, Farnborough (England).
CHIRP MODULATION SYSTEM IN AERONAUTICAL SATELLITES
G. W. Barnes, D. Hirst, and D. J. James *In* AGARD Avionics in Spacecraft Sep. 1971 10 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19398# Kansas Univ., Lawrence. Remote Sensing Lab.
RADAR IMAGING APPLICATIONS: PAST, PRESENT AND FUTURE
Richard K. Moore *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

N72-19402# Naval Research Lab., Washington, D.C. E. O. Hulbert Center for Space Research.
WAVE HEIGHT MEASUREMENTS WITH A NANOSECOND RADAR
B. S. Yaplee, A. Shapiro, D. L. Hammond, and E. A. Uliana *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p ref (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

N72-19408# Army Engineer Topographic Labs., Fort Belvoir, Va.
A MATHEMATICAL ANALYSIS OF THE PROPAGATION AND REFLECTION OF PLANE ELECTROMAGNETIC WAVES IN A NONHOMOGENEOUS ISOTROPIC MEDIUM
Richard A. Hevenor *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

N72-19422# . Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IMAGE ANALYSIS BY MULTIPLEX CODING
Andre Girard *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 15 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

N72-19426# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
THE IDENTIFICATION OF INHOMOGENEOUS MEDIA FROM TRANSIENT DIFFUSION OF ELECTROMAGNETIC FIELDS
J. N. Towle *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs (See N72-19394 10-13)
(Grants NSF GK-231; NSF GK-21218)
Avail: NTIS HC $6.00/MF $0.95

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-19234# Technische Univ., Berlin (West Germany). Fakultaet fuer Elektrotechnik.
HIGHLY PRECISE HYBRID COMPONENTS FOR NONLINEAR OPERATIVE CALCULATIONS Ph.D. Thesis [HOCHGENAUE HYBRIDE KOMPONENTEN FUER NICHTLINEARE RECHENOPERATIONEN]
Klaus Waldschmidt 5 Oct. 1970 142 p refs In GERMAN
Avail: NTIS

New, high precision computing elements are described for application in nonlinear calculations by analog- or hybrid-systems. These computing elements can be used in multiplication/division operations, transformation of polar coordinates in cartesian coordinates or reverse, general function generation and integration to an arbitrary, time-dependent variable; the latter is a generalized integration. Transl. by G.G.

N72-19235# Technische Univ., Berlin (West Germany).
THE AUTOMATED PREPARATION OF HYBRID SIMULATIONS Ph.D. Thesis [DIE AUTOMATISIERTE VORBEREITUNG HYBRIDER SIMULATIONEN]
Dieter Beckert 22 Mar. 1971 206 p refs In GERMAN
Avail: NTIS

Hybrid computer simulation is analyzed by considering the probable degree of difficulty in integrating the various steps in the programming system. The single working functions of scaling, statistical interrogation, and synthesis of automatic patch connections are mainly used to implement a hybrid computer system for statistical evaluations. Transl. by G.G.

N72-19236# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
DECISION MODELS FOR THE SELECTION OF COMPUTER SYSTEMS Ph.D. Thesis [ENTSCHEIDUNGSMODELLE FUER DIE AUSWAHL VON COMPUTERSYSTEMEN]
Gunther Diruf 19 Jul. 1971 234 p refs In GERMAN
Avail: NTIS

Rational selection of an industrial computer system is considered by evaluating its internal structure and orientation towards management goals with the help of decision and systems models. Generalized OR models are used to develop a two-step stochastic, analytical macro-model for the multiprogramming and multiprocessing operations, that requires relative minimal and easily extracted data. Data sources and receivers are humans or machines outside of the computer system. A suitable quantitative description of the work load and the functional connections between alternate configurations and overall load are obtained by using a sequential model for waiting lines. Transl. by G.G.

N72-19237*# Tulane Univ., New Orleans, La.
DIRECT MODELING PARAMETER SIGNATURE ANALYSIS AND FAILURE MODE PREDICTION OF PHYSICAL SYSTEMS USING HYBRID COMPUTER OPTIMIZATION Final Report
Robert L. Drake, Paul F. Duvoisin, Abhaya Asthana, and Thomas W. Mather 7 Dec. 1971 80 p refs
(Contract NAS8-26660)
(NASA-CR-123535; RLD-3-71) Avail: NTIS CSCL 09B

High speed automated identification and design of dynamic systems, both linear and nonlinear, are discussed. Special emphasis is placed on developing hardware and techniques which are applicable to practical problems. The basic modeling experiment and new results are described. Using the improvements developed successful identification of several systems, including a physical example as well as simulated systems, was obtained. The advantages of parameter signature analysis over signal signature analysis in go-no go testing of operational systems were demonstrated. The feasibility of using these ideas in failure mode prediction in operating systems was also investigated. An improved digital controlled nonlinear function generator was developed, de-bugged, and completely documented. Author

N72-19238# Aeronautical Research Labs., Melbourne (Australia).
REDUCTION REQUIREMENTS FOR DATA ACQUIRED BY AN AIRBORNE DATA LOGGER
K. F. Fraser Mar. 1971 74 p refs
(ARL/ME-130; ISBN-642-47676-7) Avail: NTIS

Methods to be used for reducing data recorded with an airborne magnetic tape recorder, in both analog and digital form, are described. Most of the analog recording uses frequency modulation techniques and the digital recording uses either a special serial format or a parallel format. Digital computer interface equipment, which has been developed to handle the format of the digitally recorded data, is described in detail. Included is a description of a novel electronic flywheel circuit which detects data gaps, used for word and frame synchronization, over a wide range of data rates. The recording of time-of-day in digital form allows for correlation of data reduced at different times. Data recorded in analog form may be readily correlated with data recorded in digital form. Location of any point of interest on the recorded tape is simplified by a preset stop facility which allows the analog tape machine to be stopped at any preset time of recording. Author

N72-19239*# Wolf Research and Development Corp., Riverdale, Md.
TRACKING SYSTEM STUDY
A. R. Dennis, D. Tabak, L. D. Gifford, H. M. Mednick, and J. Buchert Aug. 1969 192 p refs
(Contract NAS5-9756-138)
(NASA-CR-122366) Avail: NTIS CSCL 09B

A digital computer program was generated which mathematically describes an optimal estimator-controller technique as applied to the control of antenna tracking systems used by NASA. Simulation studies utilizing this program were conducted using the IBM 360/91 computer. The basic ideas of applying optimal estimator-controller techniques to antenna tracking systems are discussed. A survey of existing tracking methods is

given along with shortcomings and inherent errors. It is explained how these errors can be considerably reduced if optimal estimation and control are used. The modified programs generated in this project are described and the simulation results are summarized. The new algorithms for direct synthesis and stabilization of the systems including nonlinearities, are presented. Author

N72-19240# Technische Hochschule Munchen (West Germany).
ALERT AND REQUEST FORMATTING INSIDE A HYBRID SYSTEM AND SIMULTANEOUS INPUT-OUTPUT IN HIGHER PROGRAMMING LANGUAGES Ph.D. Thesis [ALARM UND ANFORDERUNGSBEARBEITUNG INNERHALBEINES HYBRIDSYSTEMS SOWIE SIMULTANE EIN-AUSGABE IN HOEHEREN PROGRAMMIERSPRACHEN]
Wolfgang Ehrenberger 22 Jul. 1971 19 p refs In GERMAN
Avail: NTIS

A hybrid computer is described that uses the priority alert system for the analog computer and the demand system for the standard periphery. Data processing takes place either through the organizational program or directly through the applications program. Work in higher computer languages uses a prerun to eliminate time losses during insertion into the alert program and by transfer from the coding part into the ALGOL- or FORTRAN-part. Transl. by G.G.

N72-19241# Joint Publications Research Service, Washington, D.C.
FIFTH ALL-UNION CONFERENCE ON CONTROL PROBLEMS
6 Mar. 1972 55 p refs Transl. into ENGLISH from the book "V Vsesoyuznoye Soveshchaniye po Problemam Upravleniya, Referaty Dokladov" Moscow, Nauka Press, 1971 pts. 1-3
(JPRS-55352) Avail: NTIS

Problems in the areas of automatic control, algorithms and mathematical models, and computer construction are considered. Topics discussed include scheduling theory, open control, optimization, applications to maritime transportation and arc welding, personnel training, operations research, adaptive human operator models, and computation processes in microelectronics. K.P.D.

N72-19242*# Stanford Research Inst., Menlo Park, Calif.
ADVANCED INTELLECT-AUGMENTATION TECHNIQUES
D. C. Engelbart Washington NASA Feb. 1972 202 p refs
(Contract NAS1-7897; SRI Proj. 7079)
(NASA-CR-1827) Avail: NTIS CSCL 09B

User experience in applying our augmentation tools and techniques to various normal working tasks within our center is described so as to convey a subjective impression of what it is like to work in an augmented environment. It is concluded that working-support, computer-aid systems for augmenting individuals and teams, are undoubtedly going to be widely developed and used. A very special role in this development is seen for multi-access computer networks. Author

N72-19243*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUPPORT SOFTWARE FOR THE ADVANCED ON-BOARD PROCESSOR
Jan. 1972 104 p Prepared by CSC
(Contract NAS5-11790)
(NASA-TM-X-65843; X-715-72-11) Avail: NTIS CSCL 09B

The support software package is described which exists for the advanced on-board processor (AOP) being developed as a general purpose stored program digital computer, with an 18-bit word. Author

N72-19244# California Univ., Livermore. Lawrence Radiation Lab.
SCEPTRE USER'S MANUAL
Harold W. Carter 1 Sep. 1971 41 p refs
(Contract W-7405-eng-48)
(UCID-30022) Avail: NTIS

This manual describes SCEPTRE, the program for computer aided electronic circuit design, as it is used at the Lawrence Livermore Laboratory (LLL). The manual (1) presents the input language for SCEPTRE, (2) describes the control of SCEPTRE from a TTY terminal at LLL, and (3) gives results from several detailed examples. Active device modeling and other unique features of the program are also described. The manual is written as both a primer for the uninitiated as well as a reference manual for experience SCEPTRE users. Author

N72-19245# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Inst. fuer Datenverarbeitungsanlagen.
CORE STORE FOR SPACE INSTRUMENTS (TECHNICAL POTENTIAL, COMPARISON WITH SEMICONDUCTOR STORES) [KERNSPEICHER FUER RAUMFAHRTGERAFTE (TECHNISCHES POTENTIAL, VERGLEICH MIT HALBLEITERSPEICHERN)]
F. Gliem Deut. Ges. fuer Luft- und Raumfahrt 1971 18 p In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

A comparison is made of ferrite core storage, complementary MOS cells, and dynamic MOS cells for spacecraft applications. The following characteristics are compared: quiescent power consumption for one bit storage, energy consumption for reading and writing one bit, and weight for one bit storage capacity. It is that while the complementary MOS cell is always inferior to the ferrite from the point of view of consumption, this is only the case for the dynamic MOS cell above a limiting bit frequency growing with capacity. Complementary MOS cells are lightest in weight for capacities up to 4K bits. Core and dynamic MOS are equal in weight. ESRO

N72-19246# Praxis Calcolo, S.p.A., Milan (Italy). Dept. di Ricerca e Programmazione.
MULTI-SATELLITE SCHEDULING Final Report
31 Dec. 1971 75 p
(Contract ESTEC-291-70-AR)
Avail: NTIS

The operation of a routine for the optimal scheduling of satellite playbacks is described as well as the main attempts made to solve conflicting situations, such as when two or more satellites are scheduled for playing back to the same ground station within a short time interval. Finally, a description of the program is given. ESRO

N72-19247# Transportation Systems Center, Cambridge, Mass.
LARGE SCALE SYSTEMS: A STUDY OF COMPUTER ORGANIZATION FOR AIR TRAFFIC CONTROL APPLICATIONS
John Dumanian and David Clapp 15 Jun. 1971 155 p refs
(AD-733759; DOT-TSC-FAA-71-15) Avail: NTIS CSCL 09/2

Based on current sizing estimates and tracking algorithms, some computer organizations applicable to future air traffic control computing systems are described and assessed. Hardware and software problem areas are defined and solutions are outlined. Author (GRA)

N72-19248# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONIC DIGITAL COMPUTERS AND THE EFFECTIVENESSES OF THIER APPLICATION
E. G. Larchenko and V. A. Dvoskin 28 Sep. 1971 15 p refs Transl. into ENGLISH from the monograph "Geodeziya i Kartografiya" USSR, no. 6, 1970 p 26-30
(AD-733851; FTD-MT-24-1400-71) Avail: NTIS CSCL 09/2

The paper contains a discussion of the effectiveness of using digital computers in geodesy. It is pointed out that almost all geodetic enterprises and institutions use digital computers to

one extent or another to process the results of field measurements, for adjustment of graticules and in solving economic and other problems. However, it is not economically expedient to solve engineering economic and geodetic problems under all conditions and on all digital computers. Author (GRA)

N72-19249# Visidyne, Inc., Woburn, Mass.
OPTIR 2, VOLUME 1
Oscar P. Manley, Henry J. P. Smith, Yvain M. Treve, Jack W. Carpenter, and Thomas C. Degges 8 Sep. 1971 197 p refs
(Contract F19628-70-C-0097; AF Proj. 5710)
(AD-734046; VI-52-1-Vol-1; AFCRL-71-0528(1)-Vol-1) Avail: NTIS CSCL 09/2

The report documents the second generation version of the OPTIR Code - OPTIR II. The effort is aimed at establishing the basic physical principles underlying the widespread, long term optical/infrared radiation observed following atmospheric nuclear detonations. The results of such studies are crucial to the design and evaluation of optical surveillance, detection, discrimination, tracking and homing systems and future laser communication systems, all of which must be able to function in a nuclear environment. GRA

N72-19250# Visidyne, Inc., Woburn, Mass.
OPTIR 2, VOLUME 2
Oscar P. Manley, Henry J. P. Smith, Yvain M. Treve, Jack W. Carpenter, and Thomas C. Degges 8 Sep. 1971 197 p refs
(Contract F19628-70-C-0097; AF Proj. 5710)
(AD-734047; VI-52-2-Vol-2; AFCRL-71-0528(2)-Vol-2) Avail: NTIS CSCL 09/2

The report, Volume 2, describing the OPTIR 2 computer code is an extension of Volume 1 pertaining to various models of the radiation effects of nuclear explosions. GRA

N72-19251# Visidyne, Inc., Woburn, Mass.
OPTIR 2, VOLUME 3
Oscar P. Manley, Henry J. P. Smith, Yvain M. Treve, Jack W. Carpenter, and Thomas C. Degges 8 Sep. 1971 148 p refs
(Contract F19628-70-C-0097; AF Proj. 5710)
(AD-734048; VI-52-3-Vol-3; AFCRL-71-0528(3)-Vol-3) Avail: NTIS CSCL 09/2

The report, Volume 3 of the OPTIR 2 computer code describes various models employed in the code. GRA

N72-19252# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
A STUDY IN DESCRIPTIVE REPRESENTATION OF PICTORIAL DATA
O. Firschein and M. A. Fischler Feb. 1971 39 p refs
(Contract N00014-70-C-1239)
(AD-734012; LMSC-6-83-71-3) Avail: NTIS CSCL 05/2

There has been little study of pictorial descriptions of the type capable of being produced by a human observer. Such studies are important, not only for retrieval applications, but also because they give insight into the subtle deductive capabilities of the human, and indicate the type of epistemological knowledge required to automate the descriptive process. An approach is presented for obtaining such descriptions, deriving the canonical forms, and dealing with the problem of completeness. Observations are made concerning deductive and metadescriptive aspects of description, based on experiments using subjects having various backgrounds and 'sets'. The symbolic representation derived from such descriptions is thought of as an encyclopedia entry for the body of knowledge residing in the photograph. Author (GRA)

N72-19253# Rome Air Development Center, Griffiss AFB, N.Y.
CRT GRAPHICS CONSOLES: AN AID TO SELECTION
Lesley D. Jacobs Nov. 1971 86 p refs
(AD-734247; RADC-TR-71-61) Avail: NTIS CSCL 09/2

Computer driven, on-line, cathode ray tube devices i.e. CRT graphics consoles, have only recently made the transition from the 'research and development stage' to the user-oriented environment. The wide range and variety of consoles, costs, capabilities, and performance require that the console buyer intelligently and discriminatingly select the display and features which best meet his requirements for the least overall cost. To assist in the selection of such a console is the purpose of this report. Included in the report is information which will explain the technology-the 'how and why'-behind graphic CRT displays, describe basic display capabilities, terminology, functions and relative merit and comparatively discuss display techniques and devices. Finally, a current listing (as of 1 Oct 70) of specific displays, capabilities and costs is provided. Author (GRA)

N72-19254# Stanford Research Inst., Menlo Park, Calif.
A CAUSALITY REPRESENTATION FOR ENRICHED ROBOT TASK DOMAINS
Peter E. Hart, Nils J. Nilsson, and Ann E. Robinson Dec. 1971 19 p
(Contract N00014-71-C-0294; SRI Proj. 1187)
(AD-734140) Avail: NTIS CSCL 06/4

Existing robot projects in the field of artificial intelligence have concentrated on tasks wherein the robot must excite an action in order to change the current state of its environment. In the report the authors consider other families of tasks, such as those involving the inhibition of an action or the maintenance of the current state of its environment. In particular, the authors propose a representation for knowledge that a robot would need if it is to solve problems from such task domains. Author (GRA)

N72-19255# Naval Air Systems Command, Washington, D.C.
ADVANCED AVIONIC DIGITAL COMPUTER DEVELOPMENT PROGRAM Progress Report
Ronald S. Entner 1 Nov. 1971 85 p refs
(AD-734143; PR-9) Avail: NTIS CSCL 09/2

Contents: Preliminary statement of work of a plan to define high order language primitives for the AADC; Documentation supporting request for approval of RFP for high level programming study; NAVAIR R and D program in aircraft power systems for the 1970's. GRA

N72-19256# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
MOMENT METHODS FOR THE IDENTIFICATION OF THREE DIMENSIONAL OBJECTS FROM OPTICAL IMAGES M.S. Thesis
Sahibsingh Amulsingh Dudani Aug. 1971 112 p refs
(Grant AF-AFOSR-2048-71; AF Proj. 9769)
(AD-734781; AFOSR-72-0002TR) Avail: NTIS CSCL 09/2

The approach presented here makes use of the theory of two-dimensional moment invariants for planar geometric figures developed by Ming-kue Hu. Complete systems of moment invariants under translation, similitude and orthogonal transformations are derived. By carefully utilizing these properties, a sample set is constructed in which each sample is represented by a vector which characterizes the image for a certain orientation of some object from the given group. A pattern recognition technique is then described in which a parametric representation of the input signal is employed. The decision process using typical samples partitions the space into regions that envelop the chosen samples of a class. A simulation program based on the above outline is successfully developed which not only identifies objects, but also determines their orientation and position in space. Author (GRA)

N72-19257# Ohio State Univ., Columbus. Dept. of Computer and Information Science.
COMPUTER RECOGNITION OF THREE DIMENSIONAL OBJECTS FROM OPTICAL IMAGES Ph.D. Thesis
Jeram Godhumal Advani Aug. 1971 157 p refs
(Grant AF-AFOSR-2048-71; AF Proj. 9769)

(AD-734777; AFOSR-72-0013TR) Avail: NTIS CSCL 09/2

The dissertation has been concerned with the problem of classification of a solid object and the estimation of the six parameters characterizing its position from a discrete set of data points associated with the silhouette of a solid object. This has been achieved by the development of a computer oriented algorithm which can successfully classify and estimate the six parameters of a parallelepiped, a winged parallelepiped and an airplane. The feasibility of the recognition algorithm has been investigated by using the simulated data points of these three objects. The recognition scheme is finally applied to estimate the parameters of an aircraft from the data points generated on the boundary of a real picture. Author (GRA)

N72-19258# RAND Corp., Santa Monica, Calif.
THE DATA RECONFIGURATION SERVICE: AN EXPERIMENT IN ADAPTABLE, PROCESS/PROCESS COMMUNICATION
R. H. Anderson, V. Cerf, E. F. Harslen, J. F. Heafner, J. Madden, B. Metcalfe, A. Shoshani, J. White, and D. Wood Jul. 1971 23 p refs Presented at 2d Symp. on Probl. in the Optimization of Data Commun. Sys., Stanford, Calif., 20-22 Oct. 1971
(AD-735078; P-4673) Avail: NTIS CSCL 09/2

The nationwide ARPA Network is composed of different host computers at geographically separated sites that are interconnected by small, standardized computers (IMPs) and 50K-bit communication lines leased from the common carriers. Of primary concern are the fundamental intercommunication problems inherent in the marriage of autonomous hardware and software. This paper discusses one recent approach for providing a kind of data transformations in a way that is transparent to the terminals and programs involved. Author (GRA)

N72-19502# Royal Aircraft Establishment, Farnborough (England). Space Dept.
DATA STORAGE FOR SMALL SCIENTIFIC SPACECRAFT
A. C. Christmas and A. H. Spooner *In* AGARD Avionics in Spacecraft Sep. 1971 5 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19503# Royal Aircraft Establishment, Farnborough (England).
A MODULAR SPACECRAFT PCM DATA CONDITIONING SYSTEM
L. Smith and K. McDonald (Marconi Space and Defense Systems, Ltd.) *In* AGARD Avionics in Spacecraft Sep. 1971 17 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19505# Marconi Space and Defence Systems, Ltd., Portsmouth (England).
USE OF COMPUTERS FOR REAL TIME SATELLITE CHECKOUT
M. A. Skinner *In* AGARD Avionics in Spacecraft Sep. 1971 5 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-19259# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany).
THE METAL ISOLATOR SEMICONDUCTOR DIODE AS VARACTOR Ph.D. Thesis [METALL-ISOLATOR-HALBLEITER DIODE ALS VARAKTOR]
Jurgen Marquardt 22 May 1971 85 p refs In GERMAN
Avail: NTIS

The behavior of MIS varactors is determined by majority carriers, minority carriers, and the surface properties at the boundary between semiconductor and isolator. Measurements on frequency multipliers and parametric amplifiers confirm that a simple varactor model with only majority carriers is sufficient to describe a MIS varactor for high frequency applications.
Transl. by G.G.

N72-19260# Technische Hochschule Munchen (West Germany).
CORRELATION OF AMPLITUDE AND FREQUENCY-FLUCTUATIONS IN OSCILLATORS Ph.D. Thesis [KORRELATION DER AMPLITUDEN- UND FREQUENZSCHWANKUNGEN IN OSZILLATOREN]
Hans-Jorg Thaler 23 Jul. 1970 31 p refs In GERMAN
Avail: NTIS

A realistic oscillator model with bipolar equivalent-circuit diagram is used to generate an interference theory for calculating oscillator noise in the carrier vicinity. An AM/FM conversion resulting from the amplitude response of the reactive component of the active impedance, and/or a FM/AM conversion caused by frequency dependence of the active component of the load impedance produce a correlation between oscillator amplitude fluctuation and frequency. Methods for oscillator noise reduction are considered that are based on decoupling of amplitude- and frequency-fluctuations. Transl. by G.G.

N72-19261*# Bendix Corp., Sidney, N.Y. Electrical Components Div.
MATERIALS INVESTIGATION AND TESTS FOR THE DEVELOPMENT OF SPACE COMPATIBLE ELECTRICAL CONNECTORS Final Report, 1 Feb. - 29 Oct. 1971
Carl Pomeroy and Thomas McCabe 12 Nov. 1971 26 p
(Contract NAS8-26054)
(NASA-CR-123537) Avail: NTIS CSCL 09A

A molding study of compounds based on copolymers of highly fluorinated olefins and of flame retardant silicone is reported. Both single cavity and four cavity molds having size 22 and 24 holes with three webs in each hole were used. Also covered are dielectric strength, arc resistance, Bashore rebound, and maintenance aging tests on the various materials that have been successfully molded. Author

N72-19262*# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
SOLID STATE Ku-BAND POWER AMPLIFIERS, PHASE 1 Final Report, Aug. - Dec. 1971
M. Cohn, D. C. Buck, and B. D. Geller Jan. 1972 79 p refs
(Contract NAS5-20291)
(NASA-CR-122367) Avail: NTIS CSCL 09E

A proposed solid-state K sub u-band power amplifier utilizing a circularly symmetric array of IMPATT diodes mounted in a single radial line power combiner is discussed and its performance predicted. The proposed amplifier configuration consists of a TM sub 030 mode radial line cavity containing 20 IMPATT diodes, with separate input and output ports provided by a ferrite circulator. Conventional IMPATT amplifier techniques preclude the achievement of gain, power output, efficiency, and IMP suppression specifications simultaneously; there fore, several novel techniques with the potential of reducing the intermodulation product level are discussed. Author

N72-19263# Compagnie Francaise Thomson-Houston, Paris (France). Lab. Central de Recherches.
STUDY OF NOISE IN THE GUNN EFFECT [ETUDE DU BRUIT DANS L'EFFET GUNN]
M. Armand [1970] 8 p refs In FRENCH Sponsored by Deleg. Gen. a la Rech. Sci. et Tech.
Avail: NTIS

A preliminary report is presented of the study of a measurement technique for evaluating noise level in Gunn diodes. The equipment used is described and the value of the first results were checked against known parameters. ESRO

N72-19264# Compagnie Francaise Thomson-Houston, Paris (France). Lab. Central de Recherches.
SYSTEMATIC STUDY OF NONLINEAR AND PARAMETRIC EFFECTS IN OSCILLATORS USING GUNN EFFECT IN GALLIUM ARSENIDE Final Report [ETUDE SYSTEMATIQUE DES EFFETS NON LINEAIRES ET PARAMETRIQUES DANS LES OSCILLATEURS UTILISANT L'EFFET GUNN DANS L'ASGA RAPPORT FINAL]
M. Armand [1970] 61 p refs In FRENCH Sponsored by Deleg. Gen. a la Rech. Sci. et Tech.
Avail: NTIS

The theory of mixing oscillators is presented considering a Gunn effect oscillator as being the association of an active part which can produce power at several frequencies, and a passive part with discrete resonance capacities which determine the frequency levels at which the system can exchange power with the external medium. An experimental study has shown good agreement with the theory which can also be used to study the influence of the low frequency circuit on the noise in the high frequency oscillator. It is shown also that the mixing oscillator has a rather high noise factor due to the Schottky effect so that its use is restricted to cases when a low sensitivity is required. The problem of negative resistance oscillators is also examined. ESRO

N72-19265# North American Philips Co., Inc., Briarcliff Manor, N.Y.
RESEARCH AND DEVELOPMENT OF LOW-LIGHT-LEVEL/NEAR INFRARED CAMERA TUBE WITH SOLID-STATE ARRAY TARGET Final Report, 21 Apr. - 21 May 1971
Michael Poleshuk and Alfred Milch Oct. 1971 85 p refs
(Contract DAAB07-69-C-0263; DA Proj. 1H6-62705-A-055)
(AD-734333; ECOM-0263-F) Avail: NTIS CSCL 09/5

The research and development on a low-light-level/near infrared TV camera tube with a solid state array target was divided into three major tasks: (1) a literature study and theoretical evaluation of feasible target structures, (2) development of selected target structures, and (3) assembly and test of exploratory camera tubes. Primary performance objectives were a broad spectral response and high quantum efficiency with IR sensitivity extending beyond the capabilities of silicon vidicons. Other design objectives were low dark current, moderately high resolution, and adequate signal integration capabilities. A number of diode type target structures were considered, viz., Ge homojunctions, Ge-GaAs and Ge-Si heterojunctions and Ge homojunctions with a passivating GaAs film on the scene surface of the target. Author (GRA)

N72-19266# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
NICKEL ELECTROBONDED QUARTZ BLANKS
Joseph M. Stanley Aug. 1971 37 p refs
(DA Proj. 1S6-62705-A-058)
(AD-734329; ECOM-3452) Avail: NTIS CSCL 09/1

Problems associated with the use of conventional bonding materials for quartz resonators are reviewed briefly along with the properties of nickel films deposited from nickel sulfamate solutions. The experimental procedure for bonding quartz blanks to stainless steel mounting clips by means of such films and the method for determining their pull strengths are described. The results of microphotographic and electron micro probe examinations of bonded areas are presented to indicate the nature of the bond and the strain inducing characteristics of films deposited from sulfamate solutions. Author (GRA)

N72-19267# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF EROSION DURING PULSED DISCHARGES
O. I. Avseevich 29 Sep. 1971 24 p refs Transl. into ENGLISH of "Fiz. Osnovy Elektroiskrovoi Obrabotki Mat." Moscow, Izv.-Vo Nauka, 1966 p 32-41
(AD-734216; FTD-MT-24-915-71) Avail: NTIS CSCL 09/1

The relations characterizing the electric erosion during pulsed discharges were investigated with 54 percent Cu, 46 percent Zn alloy disk electrodes 40 mm in diameter and a C counter electrode. GRA

N72-19268# Texas Univ., Austin. Electronics Research Center.
RESEARCH ON PIEZOELECTRIC CERAMICS Final Report
Elmer L. Hixson 1 Sep. 1971 38 p refs
(Contract Nonr-4690(00))
(AD-734178; TR-112) Avail: NTIS CSCL 09/1

A new wave equation including lateral inertia and shear was developed for stress waves in solid elastic horns. The case of the conical horn was solved and favorably compared to experimental measurements of propagating conditions. The problem of longitudinal stress waves in a rod coupling at the end to a fluid medium was solved for both a fluid tube and semi-infinite half space. The shape of the interface and the fields in both media were predicted. Limited experimental checks have been done and more are planned. Finally, it is recommended that the horn equation be applied to other types and boundary conditions and that the truncated series method of solving boundary value problems be applied to other important problems. Author (GRA)

N72-19269# Army Electronics Command, Fort Monmouth, N.J.
AN ADVANCED METHOD OF MEASUREMENT OF SPOT SIZES OF VERY HIGH RESOLUTION CATHODE-RAY TUBES
Munsey E. Crost and William R. Woolley Oct. 1971 26 p
(DA Proj. 1H6-62705-A-055)
(AD-734815; ECOM-3493) Avail: NTIS CSCL 09/1

Several methods of measurement of spot-size of a very-high-resolution cathode-ray tube (CRT) are described, and their shortcomings or inconveniences are pointed out. An advanced method is described, combining the best features of the previous methods and circumventing their disadvantages. The method consists of dissection of the spot in two orthogonal dimensions by projection of a magnified circular trace scanned on the CRT phosphor upon two orthogonal pairs of parallel slits and reading the time-progression of the light-flux transmitted. The output is displayed upon an oscilloscope, and the separation of peaks in each pair is correlated with calibrated slit-separation. Optical and electronic apparatus for accomplishing the measurements is described. Examples of oscilloscope traces are shown, and their characteristics are interpreted. Author (GRA)

N72-19270# Army Electronics Command, Fort Monmouth, N.J.
PREPARATION AND REPRODUCIBILITY OF TEMPERATURE STABLE RF FERRITES
Richard W. Babbit Jun. 1971 23 p refs
(DA Proj. 1T0-62105-A-348)
(AD-734810; ECOM-3441) Avail: NTIS CSCL 09/1

The report describes the in house development and reproducibility of temperature stable r.f. ferrite cores using flame spray hot press techniques. Author (GRA)

N72-19271# Army Electronics Command, Fort Monmouth, N.J.
EVALUATION OF SLOT LINE BENDS AT S-BAND FREQUENCIES
Elio A. Mariani Oct. 1971 23 p refs
(DA Proj. 1S1-62705-A-057)
(AD-734814; ECOM-3491) Avail: NTIS CSCL 09/1

In order to utilize the slot-transmission-line in microwave integrated circuit applications, a basic knowledge concerning the performance of various bends is necessary to implement practical circuit configurations. The report presents experimental data concerning the input impedance of several slot line bends measured in the 2 - 4 GHz frequency range. The slot line

circuits were fabricated on 0.063 inch thick, D-16 dielectric substrate metallized with aluminum tape. Results indicate that slot line bends can be easily produced which are well matched (i.e., VSWR-1.5) to 50 ohms over bandwidths approaching one-half octave. Author (GRA)

N72-19272# Army Electronics Command, Fort Monmouth, N.J.
DIRECT CURRENT AND SMALL SIGNAL ANALYSIS FOR AVALANCHE DIODE DESIGN
Maurice Druesne Nov. 1971 37 p refs
(DA Proj. 1S6-62705-A-056)
(AD-734816; ECOM-3498) Avail: NTIS CSCL 09/1

The subject of the report is the Impatt or Avalanche diode. This diode is considered first from the d.c. point of view and an analysis of its behavior under these conditions are given. The results of this analysis lead to a series of graphs relating various parameters of the diode and thus yield guide lines for the design of a specific type of diode. Next the equivalent circuit of the diode is discussed by considering the device as made up of three regions: the avalanche region, the drift zone and the inactive region arising in an abrupt type of p-n junction diode. The results of this analysis show that a negative resistance develops which explains the oscillatory character of the diode. Finally the small signal theory is developed by adding small ac components to the dc components considered previously. Author (GRA)

N72-19273# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TELSA TRANSFORMERS
Werner Heise 21 Oct. 1971 29 p refs Transl. into ENGLISH from Elektrotech. Z., A (West Berlin), v. 85, no. 1, 1964 p 1-8
(FTD Proj. 7JJ)
(AD-734989; FTD-HT-23-972-71) Avail: NTIS CSCL 09/1

Following a general discussion of Tesla transformers, a detailed study of their theory is made. It is noted that the selection of a coupling factor k has a considerable influence on the maxium attainable transmission ratio. In addition, the relationship between the rated voltage and frequency of transformers of this type shows that the correct design is of importance. Attenuation is treated in a spectial chapter. It is pointed out that the electric arc resistance generally plays an important part as a spark gap when used as a switching element on the primary side. Author (GRA)

N72-19274# Radio Corp. of America, Lancaster, Pa.
A 400 AMPERE HIGH POWER TRANSCALENT SEMICONDUCTOR THYRISTOR DEVICE, SUPPLEMENTARY REPORT NO. 2, REPORT NO. 4, 1 JANUARY - 31 AUGUST 1971
S. W. Kessler Sep. 1971 44 p refs
(Contract DAAK02-69-C-0609)
(AD-733942; Rept-4-Suppl-2) Avail: NTIS CSCL 09/1

Work performed was devoted to the development of a silicon thyristor wafer which could be cooled from both sides in the transcalent package to take maximum advantage of the thermal dissipation capabilities of the heat pipe. Author (GRA)

N72-19275# Naval Postgraduate School, Monterey, Calif.
PERIODIC AND LOG PERIODIC COUPLING MODES OF PROPAGATION
Jeffrey B. Knorr Aug. 1971 31 p refs
(AD-734967; NPS-52K071081A) Avail: NTIS CSCL 09/1

The report summarizes an investigation of the applicability of the log periodic concept to coupled microwave transmission lines. It is shown that active coupling at a given frequency may be achieved between two lines supporting waves with different phase constants provided they are coupled periodically with a periodicity determined by the difference B(2)-B(1) at that frequency. Since B(2)-B(1) will, in general, vary with frequency, coupling over a broad frequency range requires a variable period. This may be realized by scaling the structure period, thereby giving rise to a log periodic mode coupler. This technique appears to hold promise for achieving the same wideband performance that has been attained with log periodic radiators. Author (GRA)

N72-19276# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
AN IMPROVED 10 dB COUPLER
Emanuel Fliegler Aug. 1971 13 p refs
(DA Proj. 1H6-62705-A-057)
(AD-734811; ECOM-3442) Avail: NTIS CSCL 09/1

A method is presented that accounts for the shift in center frequency due to the problem of unequal even and odd modes of propagation on a microstrip transmission line coupler. A modified coupler exhibited frequency correction and enhanced coupling bandwidth, using this method. Design expressions, experimental results, and fabrication details are given. Author (GRA)

N72-19277# Electro Development Corp., Lynwood, Wash.
SOLID STATE ROTARY SWITCH Final Report, 28 Aug. 1970 - 28 Oct. 1971
W. B. Marsh Dec. 1971 34 p refs
(Contract F33615-71-C-1023; AF Proj. 3145)
(AD-734758; EDC-710928; AFAPL-TR-71-87) Avail: NTIS CSCL 09/1

The report describes the work performed on a research and development program to produce an eight position solid state rotary switch suitable for use in aircraft with solid state electrical systems. Author (GRA)

N72-19278# Institute for Defense Analyses, Arlington, Va.
LOW-LIGHT-LEVEL DEVICES: A DESIGNER'S MANUAL
Lucien M. Biberman, Frederick A. Rosell, Otto H. Schade, Sr., Alvin D. Schnitzler, and Harry L. Snyder Aug. 1971 508 p refs
(Contract DAHC15-67-C-0011)
(AD-735006; R-169) Avail: NTIS HC $6.00/MF $0.95 CSCL 09/5

The purpose of this report is to present in orderly fashion the key factors in the design, analysis, and characterization of low-light-level devices. The parameters of interest are those that have the greatest effect on the transfer of information from the scene before the lens of the television camera to the human looking at the picture tube. Part I examines specifications for low-light-level devices. Part 2 discusses criteria for image quality. Part 3 examines the human visual process and optical aids to that process under conditions of low illumination. Part 4 discusses the image intensifier as a device to aid vision at low light levels and lists the parameters of a variety of available image intensifiers. Part 5 introduces television camera tubes and develops the concepts leading to display signal-to-noise ratio. Rosell's signal-to-noise ratio at the display. It is this, the authors believe, that is the most powerful means of evaluating 'resolution', a term usually used loosely and incorrectly. Part 6 compares camera tubes on the basis of lag and display signal-to-noise ratio and discusses adverse factors such as 'burning' and 'blooming'. Part 7 sums up with some brief comments on important tube parameters and their specification. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-19279 National Lending Library for Science and Technology, Boston Spa (England).
MICROWAVE INTEGRATED CIRCUITS: PRESENT STATE AND DEVELOPMENT TRENDS
H. N. Toussaint and R. Hoffman 5 Jan. 1972 25 p refs Transl. into ENGLISH from Frequenz (West Berlin), v. 25, no. 4,

1971 p 100-110
(NLL-Trans-2801-(9022.81))

The state of art in microwave integrated circuits (MICs) is presented. After a short review of the special technology for MIC, the electrical parameters of the microstrip transmission line are discussed. Some other transmission line configurations (coplanar slot, suspended substrate line) are described along with the construction and the electrical properties of lumped elements in MIC (capacitors, inductors, resistors) and hybrid elements. Technical limits of MICs, considering maximum transferable RF-power, resonator-Q and the upper frequency bound are given, and an outlook into future developments in technology and circuit design of MICs is include. Author

N72-19280*# California Univ., Berkeley. Electronics Research Lab.
A SURVEY OF METHODS OF FEASIBLE DIRECTIONS FOR THE SOLUTION OF OPTIMAL CONTROL PROBLEMS
E. Polak [1972] 20 p refs
(Grant NGL-05-003-016; Contract F44620-71-C-0087)
(NASA-CR-125803) Avail: NTIS CSCL 09B

Three methods of feasible directions for optimal control are reviewed. These methods are an extension of the Frank-Wolfe method, a dual method devised by Pironneau and Polack, and a Zontendijk method. The categories of continuous optimal control problems are shown as: (1) fixed time problems with fixed initial state, free terminal state, and simple constraints on the control; (2) fixed time problems with inequality constraints on both the initial and the terminal state and no control constraints; (3) free time problems with inequality constraints on the initial and terminal states and simple constraints on the control; and (4) fixed time problems with inequality state space contraints and constraints on the control. The nonlinear programming algorithms are derived for each of the methods in its associated category. F.O.S.

N72-19281# Joint Publications Research Service, Arlington, Va.
AUTOMATIC CONTROL
23 Feb. 1972 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 201, no. 4, 1971 p 801-805
(JPRS-55252) Avail: NTIS

Mathematical discussions are presented on electric circuit control and design of optimal automatic control systems. For individual titles, see N72-19282 through N72-19283.

N72-19282# Joint Publications Research Service, Arlington, Va.
SIMPLE TESTORS
N. N. Ayzenberg and A. I. Tsitkin *In its* Autom. Control 23 Feb. 1972 p 1-4 refs (See N72-19281 10-10)
Avail: NTIS

The testor is defined as a modification of the concept of a test, and a simple testor is developed for classifying objects for electric circuit control and diagnostics. Theorems are proved showing that a given decision rule relates vectors from the study selection to the appropriate sets, based on Boolean functions. A testor is called deadend if any of its own subsets is not a testor, and the simple testor collections which do not contain negations of the predicates correspond to the deadend testor. N.E.N.

N72-19283# Joint Publications Research Service, Arlington, Va.
DESIGN OF OPTIMAL AND QUASI-OPTIMAL SYSTEMS OF AUTOMATIC CONTROL
R. A. Nelepin *In its* Autom. Controls 23 Feb. 1972 p 5-10 refs (See N72-19281 10-10)
Avail: NTIS

A theory of control is developed using the Sylvestor form of the matrix, and based on either local or global criteria. The method overcomes the usual difficulties of having to select weighted coefficients of the functional, having to calculate the coefficients of optimal law of control, and having to select the parameters of a real system in such a way that its processes will be distinguishable slightly from the process in the optimal system. N.E.N.

N72-19284*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
ON STOCHASTIC CONTROL AND OPTIMAL MEASUREMENT STRATEGIES Ph.D. Thesis
Leslie C. Kramer Oct. 1971 253 p refs
(Grants NGL-22-009-124; AF-AFOSR-1941-70; DSR Proj. 76265; DSR Proj. 72486)
(NASA-CR-125809; ESL-R-462) Avail: NTIS CSCL 12A

The control of stochastic dynamic systems is studied with particular emphasis on those which influence the quality or nature of the measurements which are made to effect control. Four main areas are discussed: (1) the meaning of stochastic optimality and the means by which dynamic programming may be applied to solve a combined control/measurement problem; (2) a technique by which it is possible to apply deterministic methods, specifically the minimum principle, to the study of stochastic problems; (3) the methods described are applied to linear systems with Gaussian disturbances to study the structure of the resulting control system; and (4) several applications are considered. Author

N72-19285*# National Aeronautics and Space Administration, Washington, D.C.
THE dc POWER CIRCUITS: A COMPILATION
1972 27 p
(NASA-SP-5942(01)) Avail: NTIS HC $1.00/MF $0.95 CSCL 09C

A compilation of reports concerning power circuits is presented for the dissemination of aerospace information to the general public as part of the NASA Technology Utilization Program. The descriptions for the electronic circuits are grouped as follows: dc power supplies, power converters, current-voltage power supply regulators, overload protection circuits, and dc constant current power supplies. F.O.S.

N72-19286*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRONIC CIRCUITS FOR COMMUNICATIONS SYSTEMS: A COMPILATION
[1972] 34 p refs
(NASA-SP-5950(01)) Avail: NTIS HC $1.00/MF $0.95 CSCL 09C

The compilation of electronic circuits for communications systems is divided into thirteen basic categories, each representing an area of circuit design and application. The compilation items are moderately complex and, as such, would appeal to the applications engineer. However, the rationale for the selection criteria was tailored so that the circuits would reflect fundamental design principles and applications, with an additional requirement for simplicity whenever possible. Author

N72-19287# Bunker-Ramo Corp., Westlake Village, Calif.
COMPARATIVE STUDY OF CONTROL AND FEEDBACK TECHNIQUES Final Report
R. W. Obermayer Jan. 1971 343 p refs
(Contract F44620-69-C-0123; AF Proj. 9778)
(AD-731537; AFOSR-71-2586TR) Avail: NTIS HC $6.00/MF $0.95 CSCL 06/4

The report provides a historical and political survey of Soviet Cybernetics and then discusses in detail specific work in self-organizing systems, design problems, Theory of Adaptive Systems and the computer simulation of the work of V. A. Yakubovich. The simulation includes the problem mechanization, procedures, problem variables and a complete analysis of the computer data. A Computerized Link Analysis System (CLANS) for the retrieval of pertinent information and relational aspects concerning individuals and organizations is presented in Volume III. A complete bibliography of approximately 1400 items is presented in the Appendix. Author (GRA)

N72-19288# Alabama Univ., Huntsville. Research Inst.
STABILIZATION OF DYNAMICAL SYSTEMS WITH DYNAMICAL FEEDBACK CONTROLLERS, PART 1 Final

Technical Report, Feb. 1970 - Nov. 1971
C. D. Johnson Nov. 1971 100 p refs
(Contract DAAH01-70-C-0762)
(AD-733939) Avail: NTIS CSCL 12/1

The report discusses the following topics: State overdescription and the physical origins of uncontrollability; Minimal order dynamical controllers; Stabilization of linear dynamical systems with dynamical output-feedback controllers; and, Stabilization of dynamical systems in the presence of external disturbances. GRA

N72-19289# New York Univ., N.Y. Dept. of Electrical Engineering.
UNIFYING CONCEPTS OF SYSTEMS APPLICABLE TO AEROSPACE SYSTEMS Final Report, 1 Oct. 1967 - 31 Aug. 1971
Anthony J. Grammaticos and John R. Ragazzini Sep. 1971 33 p refs
(Grant AF-AFOSR-1393-68; AF Proj. 9749)
(AD-734072; TR-400-219; AFOSR-71-3065TR) Avail: NTIS CSCL 12/1

The main areas of research which have been investigated are linear systems with unknown input gains, neutrality and separability properties of dual control algorithms, the controllability of fixed linear systems, compatible suboptimal controllers for the constrained dynamic compensation of linear systems and multi-reflective regulation of heart rate during lung inflation. In the case of discrete-time filters, a numerical algorithm was derived for calculating the output of the filter which adapts to its own noise. The derivation of the optimal control law for linear systems with unknown input gains is another new result of this research effort. Results of the investigation in dual control include the establishment of a separation property for certain problems of identification and control as well as the establishment of certain neutrality and separability properties of dual control algorithms. Author (GRA)

N72-19290# New York Univ., N.Y. Dept. of Electrical Engineering.
CONTROL SYSTEMS RESEARCH Final Report, 1 Nov. 1968 - 31 Oct. 1971
Phillip E. Sarachik Dec. 1971 11 p refs
(Grant AF-AFOSR-1526-68; AF Proj. 9749)
(AD-734783; AFOSR-72-0011TR) Avail: NTIS CSCL 12/1

The report discusses the research effort which concentrated mainly on problems that arise in optimally controlling systems without using differentiators or infinite gains when state observation noise is singular. Work also began on control of distributed systems under a variety of constraints, and a paper discussing two accelerated gradient computational methods was published. Author (GRA)

N72-19485# Royal Aircraft Establishment, Farnborough (England). Space Dept.
HYBRID MICROCIRCUIT TECHNOLOGY IN THE BRITISH NATIONAL SPACE PROGRAM
H. D. Fisher *In* AGARD Avionics in Spacecraft Sep. 1971 15 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19486# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
CIRCUIT DESIGN FOR SPACECRAFTS WITH COMPLEMENTARY MOS INTEGRATED CIRCUITS
W. Schambeck *In* AGARD Avionics in Spacecraft Sep. 1971 10 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19489# Montecatini Edison S.p.A., Milan (Italy).
INTEGRATED CHECK-OUT SYSTEM FOR SPACE LAUNCHERS AND AIRCRAFT SYSTEMS
Mauro Falleni *In* AGARD Avionics in Spacecraft Sep. 1971 16 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19501# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE APPLICATION OF COMPLEMENTARY MOS CIRCUITS IN PCM SYSTEMS AS A QUALIFICATION TEST
Manfred Mozer *In* AGARD Avionics in Spacecraft Sep. 1971 6 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-19291*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE REQUIREMENTS FOR A NEW FULL SCALE SUBSONIC WIND TUNNEL
Mark W. Kelly, Marion O. McKinney, and Roger W. Luidens Feb. 1972 30 p refs
(NASA-TM-X-62106) Avail: NTIS CSCL 14B

Justification and requirements are presented for a large subsonic wind tunnel capable of testing full scale aircraft, rotor systems, and advanced V/STOL propulsion systems. The design considerations and constraints for such a facility are reviewed, and the trades between facility test capability and costs are discussed. Author

N72-19292*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
REFURBISHMENT AND TESTING OF ORBITING PRIMATE EXPERIMENT HARDWARE FOR THE STUDY OF EXTENDED WEIGHTLESSNESS Final Report
R. B. Maine 7 Feb. 1972 222 p refs
(Contract NAS1-10474)
(NASA-CR-112017) Avail: NTIS CSCL 14B

The hardware for the technical feasibility demonstration models for weightlessness analysis was improved, and a 60-day test was conducted. The results are presented in detail. Author

N72-19293# Joint Publications Research Service, Washington, D.C.
A MEGAVOLT ENERGY DENSIFIER
Ye. A. Abramyan, V. A. Kornilov, V. M. Lagunov, A. G. Ponomarenko, and R. I. Solukhin 24 Feb. 1972 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR. Tekhn. Flz. (Moscow), V. 201, no. 1, 1971 p 56-59
(JPRS-55265) Avail: NTIS

Experiments were conducted which led to the construction of a megavolt energy densifier. The possibility of using specially purified distilled water as a dielectric was investigated. With an optimum system for energy densification, it was possible to feed specific powers of p almost equal to 3 X 10 to the 9th power watts per load, due to the high dielectric permeability of water and comparatively high electrical resistance. K.P.D.

N72-19294# Aeronautical Research Labs., Melbourne (Australia).
AN INVESTIGATION OF THE EFFECTIVENESS OF SEVERAL TYPES OF JET BLAST FENCES PROPOSED FOR USE AT AUSTRALIAN AIRPORTS

P. T. Malone May 1971 42 p refs
(ARL/A-Note-329) Avail: NTIS

A qualitative model investigation of the effectiveness of several jet blast fences proposed for use at Australian airports was carried out. Visual studies were made of the deflection of a compressed air jet by the fence, the flow in front of and behind the fence, and the flow at a simulated building face some distance behind the fence. The Boeing-Blackstone vane fence was found to be the most effective of those tested, and in general, fences designed to ingest and deflect, rather than purely deflect, the jet blast were observed to be superior. Author

N72-19295*# Matrix Research Co., Alexandria, Va.
THE DEVELOPMENT OF A LUNAR HABITABILITY SYSTEM
David T. Schowalter and Thomas B. Malone Washington NASA Feb. 1972 137 p refs
(Contract NASw-1941)
(NASA-CR-1676) Avail: NTIS CSCL 13B

Lunar shelter habitability requirements and design criteria are presented. The components of lunar shelter habitability studied are: (1) free volume, (2) compartmentalization, (3) area layout arrangement, (4) area use frequency/duration furnishings, (5) equipment operability, (6) decor, (7) lighting, (8) noise, (9) temperature, and (10) growth potential. Author

N72-19296# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE TELEMETRY AND TRACKING SYSTEM (TEA) OF THE CENTRAL GERMAN GROUND STATION (Z-DBS) DESCRIPTION AND MEASUREMENT RESULTS
F. Neugebauer et al Apr. 1971 7 p refs
(DLR-Mitt-71-16) Avail: NTIS

The telemetry and tracking subsystem for the first stage of the Central German Ground Station is described. The technical requirements placed on the complete receiving system had to be met by the firms charged with this contract. For the acceptance of the telemetry and tracking unit, measurement procedures were developed. Using the results of these measurements the extent to which requirements were fulfilled is described. Author

N72-19297# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen Oberpfaffenhofen.
THE TRANSMITTING AND RECEIVING ANTENNA SYSTEM (SEA) OF THE GERMAN MAIN SATELLITE GROUND STATION (Z-DBS), DESCRIPTION AND MEASUREMENT RESULTS
H. Oettl, M. G. Fey, H. Goessl, H. Haerter, H. Holl, S. Modabber, and F. Neugebauer 1971 98 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-71-10) Avail: NTIS

The transmitting and receiving (monopulse) antenna system (SEA) complete with accessories, which was installed as the first stage of the German Main Satellite Ground Station is described and information about the technical requirements (concept) and the two antennae required for telemetry, tracking, and command is given. Checks with movable signal sources (satellites) and antenna measurements (radiation-pattern and gain) as well as the measurements on the comparators and rotary joints have been completed successfully. The final test report on the antenna rotators indicates which specifications were exceeded (control loop) and which could not be met (resonance frequency). Author

N72-19298# Boeing Scientific Research Labs., Seattle, Wash.
ANALYSIS OF GROUND OPERATIONS AT AIRPORTS
R. Cairns Jul. 1971 52 p refs Sponsored by DOT
(AD-733111; D1-82-1042) Avail: NTIS CSCL 13/2

The pollution source inventory for airports include airplane operations (categorized according to taxi, idle, take-off, and landing), aircraft support vehicle operations, vehicular movements, stationary power and heat-source operations, and fueling operations. Also measurements are given of carbon monoxide, hydrocarbons, particulates, oxides of nitrogen and meteorological parameters. A mathematical dispersion model is used to derive contour maps of individual pollutant concentrations.
Author (GRA)

N72-19299# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON ACCELERATORS (SELECTED ARTICLES)
V. I. Perevodchikov, A. N. Pokras, A. A. Vorobev, M. Yu. Geltsel, and A. I. Bessonov 28 Sep. 1971 59 p refs Transl. into ENGLISH from Elektronnye Uskoriteli. V Mezhvuz. Konf. (5th), Tomsk, 17-21 Mar. 1964, 1966 p 48-55, 69-74, 211-216, 278-286, 427-433
(AD-733925; FTD-HC-23-756-71) Avail: NTIS CSCL 20/7

Contents: An electron gun with a 40 - 50 a current for a pulsed linear accelerator; Development of cyclic waveguide accelerators at the Tomsk Polytechnic Institute; High voltage artificial shaping lines for modulators of linear accelerators; A nanosecond pulse generator for a synchrotron inflector; A laboratory facility for the radiation synthesis of graft materials using an electron accelerator. GRA

N72-19300# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT TEST INSTRUMENTATION
1 Nov. 1971 8 p refs
(AD-734306; MTP-6-3-526) Avail: NTIS CSCL 14/2

The document provides guidance and procedures for the proper implementation of instrumentation techniques to be utilized during the service test of aircraft and airborne equipment. Use of this document will ensure that both the instrumentation used during testing (procedures and devices) and the materiel item under test meet requirements stated in the Materiel Needs (MN), and Technical Characteristics (TC), further ensuring the materiel suitability for Army use. Author (GRA)

N72-19301# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
AN INVESTIGATION OF THE EFFECTIVENESS OF SEVERAL DEVICES IN SIMULATING A ROCKET PLUME AT FREE STREAM MACH NUMBERS 0.9 TO 1.2
James Robert Burt, Jr. 30 Sep. 1971 62 p refs
(DA Proj. 1M2-62303-A-214)
(AD-734323; RD-TR-71-22) Avail: NTIS CSCL 14/2

The effectiveness of several devices in simulating the effects of a rocket plume on the flow field of a typical missile in the transonic Mach number range was investigated. Two plume-shaped solid bodies and three step-type plume simulators were tested. The effects on model pressure distribution of small angle of attack and plume-simulator position were investigated. The analysis showed that all the plume simulators tested can give approximately the same model afterbody pressure distribution at transonic Mach numbers and small angles of attack as an actual rocket plume. Author (GRA)

N72-19302# Maxwell Labs., Inc., San Diego, Calif.
HIGH CURRENT, LOW IMPEDANCE ACCELERATORS Final Report
A. R. Miller, D. R. Adcock, D. Markins, R. White, and A. C. Kolb 2 Dec. 1971 85 p refs
(Contract DASA01-70-C-0045; DASA Proj. NWER-XAXL)
(AD-734399; MLI-111; DNA-2746F) Avail: NTIS CSCL 20/7

A low impedance high power pulsed electron beam accelerator utilizing a water dielectric coaxial pulse line has been developed. The electron pulse is initiated by the simultaneous triggering of four parallel, 2 MV, low inductance, gas insulated spark gap switches with a scatter of less than 2 ns. The electron beam pulse, produced in a 15 nH field emission diode, has a peak amplitude of 835 keV at 850 kA, a 1/e current risetime of 20 ns and a duration of 80 ns. The 1.5 ohm pulse line is directly charged from a fast Marx generator and is matched through the switches into a transfer section connected

to the diode. This section has sufficient shunt capacity to suppress the prepulse associated with the charging pulse. The beam power and total energy are in good agreement with the calculated output. Author (GRA)

N72-19303# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USÑAS AGANA, GUAM, MARIANA ISLANDS
H. Tomita and M. C. Chapman Sep. 1971 85 p
(NCEL Proj. 53-125)
(AD-733660; NCEL-TN-1189) Avail: NTIS CSCL 13/2

The results of a condition survey of the airfield pavements at the U. S. Naval Air Station, Agana, Guam, Mariana Islands are presented. The survey established statistically-based indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N72-19304# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNAS IMPERIAL BEACH, CALIFORNIA
H. Tomita and L. J. Woloszynski Jul. 1971 68 p ref
(NCEL Proj. 53-125)
(AD-733656; NCEL-TN-1190) Avail: NTIS CSCL 01/5

The results of a condition survey of the airfield pavements at the USNAS Imperial Beach, California are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N72-19305# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
STRUCTURAL DESIGN AND DEVELOPMENT OF UTIAS IMPLOSION DRIVEN LAUNCHERS
W. Czerwinski Aug. 1971 67 p refs
(Contract AF 33(615)-5313)
(AD-734043; UTIAS-153) Avail: NTIS CSCL 14/2

A condensed account is given of the design effort expended in the structural development of the implosion-driven hypervelocity launchers at the Institute for Aerospace Studies, over the past few years. This type of experimental research equipment is subjected to loads whose modes and magnitude do not occur in any other related mechanical arrangement. Therefore, it should be considered as a highly advanced design problem. The design of a strong enclosure and barrel assembly presents a very great challenge from the standpoint of safety and economy of operation, owing to unusually high internal pressures and extreme temperatures. Based on observations made during the running and testing of several launcher models at UTIAS, some recommendations are made at the end of this report with respect to the eventual future development of such launchers. Author (GRA)

N72-19306# Naval Ordnance Lab., White Oak, Md.
EVALUATION OF TWO TYPES OF FACILITIES TO FULFILL THE NEED FOR HIGH REYNOLDS NUMBER TRANSONIC TESTING
Kurt R. Enkenhus and David L. Merritt 30 Jul. 1971 251 p refs
(ONR Proj. RR009-02-01)
(AD-734648; NOLTR-71-147) Avail: NTIS CSCL 14/2

The Navy's need for high Reynolds number transonic testing is reviewed and some specific problem areas in weapon and aircraft design are cited. The abilities of currently available wind tunnels in the United States to meet those needs are assessed and the Ludwieg tube wind tunnel at NASA Marshall is evaluated. The theory of the Ludwieg tube is discussed and tables and charts of the parameters are presented. A second option to meet the high Reynolds number testing requirements is examined in the theory and design of a conventional blowdown tunnel. The costs of the two types of facilities are compared for Navy weapons and flight vehicles at subsonic, transonic and low supersonic speeds GRA

N72-19307# Air Force Systems Command, Washington, D.C.
THE TEST FACILITY'S ROLE IN THE EFFECTIVE DEVELOPMENT OF AEROSPACE SYSTEMS Final Report, 1 Sep. 1970 - Jul. 1971
James G. Mitchell Sep. 1971 199 p refs
(AD-731548; AFSC-TR-71-01) Avail: NTIS CSCL 14/2

Some of the major problems associated with the use and usefulness of aeronautical test facilities (wind tunnels, etc.) in the development of aerospace systems are defined and analyzed. Contributions to the study have come from 117 of this country's more experienced and prominent aerospace experts from government and industry. The origin of the facility test plan and the use of the test facility to support DOD system's development philosophy are explored and suggestions are made to reduce conflicting incentives and permit an expanded role for the test facility. The deficiencies in test facilities are shown to produce consequences which are resulting in higher system cost and less system performance. The major facility inadequacies are enumerated and specific examples are noted wherein lack of test capability has had detrimental effects on system performance. Thirty-five of the recent aircraft development programs are studied and evaluated to determine a procedure whereby the use of the test facility can be optimized. A multiple regression analysis is used to develop a procedure for defining an optimal facility test program. Author (GRA)

N72-19150# Civil Aeromedical Inst., Oklahoma City, Okla. Protection and Survival Lab.
DESIGN CONSIDERATIONS FOR IMPACT TEST FACILITIES
Richard F. Chandler *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 10 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19151# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
A LINEAR DECELERATION TRACK
A. F. Giles *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 9 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19152# Max-Planck-Institut fuer Arbeitsphysiologie, Dortmund (West Germany).
AN ELECTRO-HYDRAULIC SYSTEM FOR SIMULATIONS OF COLLISIONS
W. Lange *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 4 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19153# Fiat S.p.A., Turin (Italy).
FIAT CATAPULTS
E. Franchini *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p refs (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19154# Motor Industry Research Association, Lindley (England).
THE MIRA VEHICLE IMPACT TEST FACILITY

T. R. Aston *In* AGARD Linear Acceleration of Impact Type 26 Jun. 1971 8 p (See N72-19119 10-05)
Avail: NTIS HC $6.00/MF $0.95

N72-19490# Montecatini Edison S.p.A., Milan (Italy).
CONSIDERATIONS ON A SUBSYSTEM FOR HANDLING COMMANDS AND STIMULI FOR AN INTEGRATED AND AUTOMATIC CHECK OUT OF SPACE LAUNCHERS
Mauro Falleni *In* AGARD Avionics in Spacecraft Sep. 1971 19 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-19308# Technische Univ., Berlin (West Germany).
THE DEVELOPMENT OF NEGATIVE PREDISCHARGE UP TO BREAKDOWN IN AIR FOR A PRESSURE REGION OF 300 TORR UP TO 12 ATMOSPHERES Ph.D. Thesis [DIE ENTWICKLUNG DER NEGATIVEN VORENTLADUNGEN BIS ZUM DURCHSCHLAG IN LUFT IN EINEM DRUCKBEREICH VON 300 TORR BIS 12 ATMOSPHAEREN]
Peter Gruneberg 1971 98 p refs
Avail: NTIS

The development of breakdown in air from a negative predischarge is analyzed for the spherical/planar field of a spherical electrode having a large pressure region. The sparking distance/tension characteristics for various curved spherical electrodes are considered with special emphasis on stationary discharge phenomena. Townsend similarity laws are used to analyze the beginning of the first independent discharge and to obtain an interpolation formula for the initial voltage of the sphere/plate system. A physical interpretation of the observed discharge phenomena concludes the study. Transl. by G.G.

N72-19309# Laval Univ. (Quebec). Aerodynamic Lab.
STUDY OF THE REATTACHMENT CONDITIONS OF AN INCOMPRESSIBLE ANNULAR JET [ETUDE DES CONDITIONS DE RECOLLEMENT D'UN JET ANNULAIRE INCOMPRESSIBLE]
P. Rougier Oct. 1971 59 p refs In FRENCH Supported by NRC of Can.
(A-21) Avail: NTIS

The application of the generalization method to reattached jet flow and the comparing of results to experiment are discussed. Two cases are considered: that of a cylindrical annular jet attached on a wall equally cylindrical and coaxial, and that of an annular jet attached on an indefinite plane surface perpendicular to its axis. Results show that in the first case reattachment was predicted correctly by the theory. In the second case, results were acceptable for the localization of reattachment but insufficient for the pressure coefficients.
Transl. by E.H.W.

N72-19310# Laval Univ. (Quebec). Aerodynamic Lab.
QUASI-BIDIMENSIONAL THEORY FOR THE REATTACHMENT OF AN ANNULAR JET [UNE THEORIE QUASI-BIDIMENSIONELLE POUR LE RECOLLEMENT D'UN JET ANNULAIRE]
C. Bourque Dec. 1971 50 p refs In FRENCH Supported by NRC of Can.
(A-20) Avail: NTIS

The development of a quasi-bidimensional theory for the reattachment of an annular jet is discussed. The theory, a general one, covers a large number of geometric arrangements for a vehicle on an air cushion having a peripheral jet and the 'tulip effect'. Theoretical results are in good agreement with experimental ones. Transl. by E.H.W.

N72-19311# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
LIQUID IMPACT ON ELASTIC SOLID SURFACE
Y. C. Huang and F. G. Hammitt Feb. 1972 11 p refs
(Grant NSF GK-730)
(UMICH-03371-12-1) Avail: NTIS

The impact between a compressible liquid and a rigid solid has been studied analytically. The pressures and velocities during the important early portion of the impact depend upon liquid impact Mach number and droplet shape. Although liquid pressure build-up commences simultaneously with imput, the expansion of the droplet near the contact edge due to the lateral flow is not appreciable during the early stages of the impact. The maximum pressure in this two-dimensional liquid impact problem is found to be less than the one-dimensional maximum pressure. As time elapses, the maximum pressure shifts from the center of the contact area radially outward, while the pressure at the center attenuates to the stagnation pressure. The study of liquid-solid impact has been extended to include the effects of an elastic solid boundary. The preliminary results show that the deformation of the target surface due to a spherical liquid droplet impact appears as an annular ring of depression, just as observed in various experimental studies. The results of course depend upon the acoustic impedence ratio between the liquid and solid.
Author

N72-19312*# Dynamic Science, Irvine, Calif.
TRANSPIRATION AND FILM COOLING BOUNDARY LAYER COMPUTER PROGRAM. VOLUME 1: NUMERICAL SOLUTIONS OF THE TURBULENT BOUNDARY LAYER EQUATIONS WITH EQUILIBRIUM CHEMISTRY Final Report
Jay N. Levine Jun. 1971 114 p refs Prepared for JPL
(Contract NAS7-791)
(NASA-CR-125683; SN-230-Vol-1) Avail: NTIS CSCL 20M

A finite difference turbulent boundary layer computer program has been developed. The program is primarily oriented towards the calculation of boundary layer performance losses in rocket engines; however, the solution is general, and has much broader applicability. The effects of transpiration and film cooling as well as the effect of equilibrium chemical reactions (currently restricted to the H2-O2 system) can be calculated. The turbulent transport terms are evaluated using the phenomenological mixing length - eddy viscosity concept. The equations of motion are solved using the Crank-Nicolson implicit finite difference technique. The analysis and computer program have been checked out by solving a series of both laminar and turbulent test cases and comparing the results to data or other solutions. These comparisons have shown that the program is capable of producing very satisfactory results for a wide range of flows. Further refinements to the analysis and program, especially as applied to film cooling solutions, would be aided by the acquisition of a firm data base.
Author

N72-19313# Royal Aircraft Establishment, Farnborough (England).
ON THE KUTTA CONDITION AT THE NOZZLE DISCHARGE EDGE IN A WEAKLY UNSTEADY NOZZLE FLOW
D. Becher and E. Pfizenmaier Sep. 1971 30 p refs Transl. into ENGLISH of "Ueber die Abflussbedingung an der Duesenaustrittskante bei einer Schwach Instationaeren Duesenstroemung" German rept. DLR-FB-71-09
(RAE-Lib-Trans-1617; DLR-FB-71-09; BR27950) Avail: NTIS

An experimental investigation was made of the Kutta condition for a free jet leaving the trailing edge of a nozzle in weakly unsteady flow. For this purpose, velocity measurements in an acoustically disturbed nozzle flow were carried out with hot wire probes and probe microphones. The experimental results demonstrate that there is no velocity singularity of the unsteady

flow at the nozzle edge, although there would be if no steady flow were present. Further, the measurements clearly show that the unsteady part of the flow does not lead to a constant deformation of the jet boundary. Author

N72-19314*# Massachusetts Univ., Amherst. Dept. of Mechanical and Aerospace Engineering.
ON THE CALCULATION OF THREE DIMENSIONAL LAMINAR BOUNDARY LAYER FLOWS
J. A. Fillo and R. Burbank [1972] 11 p refs Sponsored by NASA
(NASA-CR-125810) Avail: NTIS CSCL 20D

An approximation which reduces the computation of three dimensional, laminar, compressible, boundary layer equations to the problem of solving two dimensional type boundary layer equations is presented. A comparison of this method with a fully three dimensional boundary layer calculation is provided. Author

N72-19315*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EVALUATION OF ONE-DIMENSIONAL APPROXIMATIONS FOR RADIATIVE TRANSPORT IN BLUNT BODY SHOCK LAYERS
K. H. Wilson Washington NASA Mar. 1972 67 p refs
(Contract NAS2-5749)
(NASA-CR-1990) Avail: NTIS CSCL 20D

One-dimensional approximations for the nongray radiative flux and flux divergence in radiating shock layers about a blunt entry body are compared with an exact three-dimensional treatment. A coupled radiative-gasdynamic analysis of the shock layer flow about the entire body provided the thermodynamic field used in these comparisons. In terms of calculating the total energy lost by the shock layer, the one-dimensional approximations to the radiative flux divergence are accurate to within a few percent. In terms of calculating the surface flux, the one-dimensional approximations introduce the largest errors of approximately 15 percent near the stagnation point. The source of these errors is the slab-like geometric representation of the shock layer inherent in all one-dimensional models. Finally, for both the radiative flux and its divergence, the tangent slab approximation provides more accurate results than differential approximation methods. Author

N72-19316*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREDICTION OF LOCAL AND INTEGRATED HEAT TRANSFER IN NOZZLES USING AN INTEGRAL TURBULENT BOUNDARY LAYER METHOD
Donald R. Boldman, James F. Schmidt, and Robert C. Ehlers Washington Mar. 1972 30 p refs
(NASA-TN-D-6595; E-6669) Avail: NTIS CSCL 20M

An empirical modification of an existing integral energy turbulent boundary layer method is proposed in order to improve the estimates of local heat transfer in converging-diverging nozzles and consequently, provide better assessments of the total or integrated heat transfer. The method involves the use of a modified momentum-heat analogy which includes an acceleration term comprising the nozzle geometry and free stream velocity. The original and modified theories are applied to heat transfer data from previous studies which used heated air in 30 deg - 15 deg, 45 deg - 15 deg, and 60 deg - 15 deg water-cooled nozzles. Author

N72-19317*# Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATION OF HEAT TRANSFER IN A GRADIENT FLOW REGION FOR PLANE TURBULENT JET IMPINGING ON A PLATE SITUATED NORMAL TO THE FLOW
A. A. Andreyev, V. N. Dakhno, V. K. Savin, and B. N. Yudayev Washington NASA Mar. 1972 12 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 18, no. 4, 1970 p 631-637
(Contract NASw-2035)
(NASA-TT-F-14195) Avail: NTIS CSCL 20/4

The experimental determination is reported of the boundary conditions required for the solution system of equations of motion, discontinuity equation, and energy equation describing heat transfer in the gradient flow region arising when a plane isothermal turbulent jet impinges on a plate situated normal to the flow. The boundary conditions are obtained in the form of a universal relation between the velocity at the outer boundary of the boundary layer, the coordinate along the plate, and the spacing between the plate and the nozzle. The relation between the heat transfer coefficient and the degree of turbulence is considered to be linear in the first approximation. This result is used as a basis for deriving formulas for the heat transfer coefficient in the gradient flow region under consideration. Author

N72-19318# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
WIND TUNNEL TESTING ON REAL CONFIGURATIONS IN HYPERSONIC FLOW. A SUMMARY OF CURRENT STUDIES AT THE DFVLR
G. Koppenwallner Jul. 1971 59 p refs
(DLR-FB-71-49; AVA-FB-7112) Avail: NTIS

A survey of the simulation facilities for high altitude hypersonic flow conditions in a German test facility is presented. Experimental activities in the field of hypersonic lifting vehicles are discussed. Fundamental research work is examined which is closely related to the typical problems of hypersonic vehicles. The experimental effort in analyzing real flow problems is outlined. Author

N72-19319# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
HEAT TRANSFER INVESTIGATIONS OF AXISYMMETRIC BODIES AT HYPERSONIC SPEEDS BY MEANS OF INFRARED MEASUREMENT
H.-J. Schepers 7 Oct. 1971 35 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-71-19) Avail: NTIS

A new method of rapid heat transfer determination over surfaces of simple hypersonic models at a Mach number of 7.0 was examined and compared with other similar methods. The heat transfer measurements were performed in a hypersonic wind tunnel Author

N72-19320# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
FORTRAN IV COMPUTER PROGRAM FOR BOUNDARY LAYERS IN COMPRESSIBLE TWO-DIMENSIONAL AND AXISYMMETRIC FLOW
J.-C. Rotta May 1970 89 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-51; AVA-FB-7113) Avail: NTIS

A computer program is described, which calculates laminar and turbulent boundary layers in compressible flow without heat transfer. The computation method is based on simultaneous integration of the integral equations for momentum and kinetic energy. The instructions, which are relevant to the user, as well as the basis of both the underlying theory and the computational procedure are presented. Two examples explain the application of the program. Author

N72-19321# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
DETERMINATION OF TURBULENT BOUNDARY LAYER PARAMETERS AND THE WALL SHEAR STRESS FROM MEASUREMENTS ON FLAT SURFACES AT SUPERSONIC SPEEDS
H.-U. Meier Jul. 1971 58 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-55; AVA-FB-7127) Avail: NTIS

Total pressure and total temperature distributions in turbulent boundary layers were determined experimentally for the flat nozzle wall of a small supersonic wind tunnel, with and without heat transfer, and on the adiabatic flat plate of a 3 ft x 4 ft supersonic wind tunnel. The measurements cover a Mach number range from M sub s = 1.75 to 4.5. Using these results, the influence on the boundary layer parameters and local skin friction coefficients of the Mach number, the Reynolds number and the amount of heat transfer are examined. Author

N72-19322# Laboratoire d'Aerothermique du C.N.R.S., Bellevue (France).

METHOD OF MEASURING LOW PRESSURES USING THERMISTORS AND DETERMINING ORIFICE EFFECTS IN RAREFIED GAS FLOW [METHODE DE MESURE DE BASSES PRESSIONS PAR THERMISTANCES ET DETERMINATION DES EFFETS D'ORIFICE DANS DES ECOULEMENTS DE GAZ RAREFIE]

J. Allegre, M. Cabaret, and M. Raffin Dec. 1971 28 p refs In FRENCH; ENGLISH summary

(Rept-71-6) Avail: NTIS

Details concerning the use of thermistors as vacuum gages are given for the pressure range between 1 and 500 microns of mercury. The thermistor device is based upon the principle that the dissipation constant of the thermistor depends on the thermal conductivity of the gas in which it is immersed. Sensitive elements are miniaturized so that they can be easily mounted, as on a wind tunnel model, for example. Orifice effects on wall pressure and impact pressure measurements were studied as a function of several flow conditions involving a wide range of Mach numbers and Reynolds numbers. The results indicate that it is possible to choose an appropriate pitot tube diameter according to actual flow conditions, in order to avoid a significant orifice effect. Author

N72-19323*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MODEL DEVELOPMENT OF SUPERSONIC TROUGH WIND WITH SHOCKS

J. M. Grebowsky Feb. 1972 31 p refs Submitted for publication

(NASA-TM-X-65848; X-621-72-53) Avail: NTIS CSCL 20D

The time dependent one dimensional hydrodynamic equations describe the evolution of the thermal plasma flow along closed magnetic field lines outside of the plasmasphere. The convection of the supersonic polar wind onto a closed fieldline results in the assumed formation of collisionless plasma shocks. These shocks move earthward as the field line with its frozen-in plasma remains fixed or contracts with time to smaller L coordinates. The high equatorial plasma temperature (of the order of electron volts) produced by the shock process decreases with time if the flow is isothermal but it will increase if the contraction is under adiabatic conditions. Assuming adiabaticity a peak in the temperature forms at the equator in conjunction with a depression in the ion density. After an initial contraction, if the flux tube drifts to higher L coordinates the direction of the shock motion can be reversed so that the supersonic region will expand along the field line towards the state characterizing the supersonic polar wind. A rapid expansion will lower the equatorial density while the temperature decreases with time under adiabatic but not isothermal conditions. Author

N72-19324*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REAL-AIR DATA REDUCTION PROCEDURES BASED ON FLOW PARAMETERS MEASURED IN THE TEST SECTION OF SUPERSONIC AND HYPERSONIC FACILITIES

Charles G. Miller, III and Sue E. Wilder Washington Mar. 1972 92 p refs

(NASA-TN-D-6618; L-7973) Avail: NTIS CSCL 20D

Data-reduction procedures for determining free stream and post-normal shock kinetic and thermodynamic quantities are derived. These procedures are applicable to imperfect real air flows in thermochemical equilibrium for temperatures to 15 000 K and a range of pressures from 0.25 N/sq m to 1 GN/sq m. Although derived primarily to meet the immediate needs of the 6-inch expansion tube, these procedures are applicable to any supersonic or hypersonic test facility where combinations of three of the following flow parameters are measured in the test section: (1) Stagnation pressure behind normal shock; (2) freestream static pressure; (3) stagnation point heat transfer rate; (4) free stream velocity; (5) stagnation density behind normal shock; and (6) free stream density. Limitations of the nine procedures and uncertainties in calculated flow quantities corresponding to uncertainties in measured input data are discussed. A listing of the computer program is presented, along with a description of the inputs required and a sample of the data printout. Author

N72-19325*# National Aeronautics and Space Administration, Washington, D.C.

THE MBB-UFE SUBSONIC PANEL METHOD. PART 2: THE LIFT-CONNECTED DISPLACEMENT PROBLEM IN COMPRESSIBLE FLOW

W. Krause Mar. 1972 141 p refs Transl. into ENGLISH of "Das MBB-UFE Unterschall-Panelverfahren. Teil 2: Das auftriebehaftete Verdraengungsproblem in kompressibler Stroemung", Messerschmidt-Boelkow-Blohm GMBH, Munich, Report UFE-633-70, 30 Oct. 1970 p 1-143

(NASA-TT-F-14117; UFE-633-70) Avail: NTIS CSCL 20D

A potential theoretical method of calculating the subcritical, compressible flow field of three-dimensional bodies of arbitrary shape is presented. Particular emphasis is placed on lift-connected flow (flow-off conditions). The mathematically highly inaccessible solution of the problem is obtained by the panel process, also called the finite element technique. The body in the flow is divided into numerous, optimally small, discrete surface elements which are occupied by individual singularities. Their thickness is obtained from a system of linear algebraic equations. The numerical treatment of this system requires extensive use of advanced computers. With the aid of sample calculations, the method is compared with experimental results and with other theories, and its suitability for practical application is demonstrated. Author

N72-19326*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DECAY OF HOMOGENEOUS TURBULENCE FROM A SPECIFIED STATE

Robert G. Deissler Washington Mar. 1972 29 p refs

(NASA-TN-D-6728; E-5761) Avail: NTIS CSCL 20D

The homogeneous turbulence problem is formulated by first specifying the multipoint velocity correlations or their spectral equivalents at an initial time. Those quantities, together with the correlation or spectral equations, are then used to calculate initial time derivatives of correlations or spectra. The derivatives in turn are used in time series to calculate the evolution of turbulence quantities with time. When the problem is treated in this way, the correlation equations are closed by the initial specification of the turbulence and no closure assumption is necessary. An exponential series which is an iterative solution of the Navier stokes equations gave much better results than a Taylor power series when used with the limited available initial data. In general, the agreement between theory and experiment was good. Author

N72-19327# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

INTEGRAL METHOD FOR THE CALCULATION OF TWO AND THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS BY USE OF SIMILARITY EQUATIONS [METHODE INTEGRALE DE CALCUL DES COUCHES LIMITES TURBULENTES BI ET TRIDIMENSIONNELLES UTILISANT DES SOLUTIONS DE SIMILITUDE]

R. Michel, C. Quemard, and J. Cousteix 1971 25 p refs In

FRENCH; ENGLISH summary Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

Theoretical results for predicting the development of two and three-dimensional turbulent boundary layers in incompressible and compressible flows are determined. In both two-and three-dimensional cases, an improved mixing length model is used; it includes an universal mixing length curve, with a correction taking into account the influence of viscosity near the wall. With this model similarity solutions to the local boundary layer equations are devised, and provide the assumptions necessary for the integral computing method. The proposed method, based on the streamwise and crosswise momentum integral equations, makes use, as auxiliary equation, of the entrainment equation. Application to and systematic comparison with experimental results are presented; the development of a turbulent boundary layer on swept wings is emphasized.
Author (ESRO)

N72-19328# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON VORTEX BURSTING
Henri Werle 1971 52 p refs In FRENCH; ENGLISH summary (ONERA-NT-175) Avail: NTIS

In order to investigate the phenomena having effect on the wakes of delta wings at high incidences, the vortex breakdown was studied using the flow visualization method. The first series of tests carried out at low speed in a hydrodynamic tunnel evidenced the analogy of vortex breakdown with boundary layer separation or wake bursting. The influence of an increasing pressure gradient on the initiation, the position, and the type of breaking was confirmed. The evolution of the vortex breakdown phenomenon is analyzed as a function of several parameters in the case of delta wings, alone or installed on aircraft models, and is compared to results of similar wind tunnel or flight tests.
ESRO

N72-19329# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HYDRODYNAMIC VISUALIZATION OF UNSTEADY FLOWS
Henri Werle 1971 43 p refs In FRENCH; ENGLISH summary (ONERA-NT-180) Avail: NTIS

The hydraulic analogy technique used for studying flow was applied to the analysis of unsteady phenomena such as boundary layer separation, wakes, etc. This visualization method was applied to the study of instabilities in the permanent regime (wakes, jets), phenomena preceding the establishment of a permanent regime (starting motion), phenomena pertaining to periodic movements of models (oscillating airfoils), the flow around rotating model (rotary wings), and the flow within rotating systems (turbomachines).
ESRO

N72-19330# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
AN EXPERIMENTAL INVESTIGATION OF SUPERSONIC BOUNDARY-LAYER FLOWS WITH PRESSURE GRADIENTS
S. Sivasegaram Aeron. Res. Council 1971 35 p refs Supersedes ARC-31586 Sponsored by Min. of Technol.
(ARC-CP-1190; ARC-31586) Avail: NTIS; HMSO: 56p; PHI: $2.45

Boundary layer measurements made in supersonic wind tunnel in two favorable and one adverse pressure gradient are analyzed. A more detailed study of some aero pressure gradient measurements, made with the same apparatus, and a study of the performance of the floating element skin friction balance in pressure gradients are included.
Author (ESRO)

N72-19331# Liverpool Univ. (England). Dept. of Mechanical Engineering.
THE PERFORMANCE OF AXIAL-FLOW COMPRESSORS OF DIFFERING BLADE ASPECT RATIO
G. T. S. Fahmi (Baghdad Univ.) London Aeron. Res. Council 1971 59 p refs Supersedes ARC-31818
(ARC-CP-1179; ARC-31818) Avail: NTIS; HMSO: 95p; PHI: $3.90

The performance of axial-flow compressors is known to be adversely affected by increasing the aspect ratio. Experimental investigations have been carried out on a single-stage, low speed axial-flow compressor with a parallel annulus and a hub-tip ratio of 0.750, at blade aspect ratios, one and two. The Reynolds number was held constant at 1.9 x 100000 and the tip clearances and blade row axial spacing at the inner diameter were kept constant. The overall performance characteristics show that the compressor of aspect ratio 1 has a wider range of operation and, in general, a higher static pressure rise than that of aspect ratio 2. It is concluded that the adverse effect of increasing the blade row aspect ratio on the performance of axial-flow compressor stages is caused by wall stall. A three dimensional flow calculation, including profile, secondary and clearance losses, and secondary distortion of flow angles is described.
Author (ESRO)

N72-19332# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
THE VELOCITIES INDUCED BY DISTRIBUTIONS OF INFINITE KINKED SOURCE AND VORTEX LINES REPRESENTING WINGS WITH SWEEP AND DIHEDRAL IN INCOMPRESSIBLE FLOW
G. G. Brebner and L. A. Wyatt London Aeron. Res. Council 1971 29 p refs Supersedes RAE-TR-70077; ARC-32389
(ARC-R/M-3667; RAE-TR-70077; ARC-32389) Avail: NTIS; HMSO: 80p; PHI: $3.35

Equations have been derived for the velocities induced in an incompressible flow by distributions of infinite source and vortex lines representing wings of infinite span and constant chord having both sweep and dihedral. Particular attention is paid to the center section where the dihedral effects are large. The equations showed that such a source distribution does not represent a wing with symmetrical sections, and that such a vortex distribution does not represent a thin wing. It is, therefore, not possible to separate the effects of wing thickness and wing load distribution, even when linear-theory assumptions are retained.
Author (ESRO)

N72-19333# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
STEADY, THREE-DIMENSIONAL PERTURBATIONS IN BOUNDARY LAYERS Final Report, 31 Dec. 1970 - 5 Nov. 1971
Raymond Sedney Nov. 1971 52 p refs
(Contract DAHC04-71-C-0009)
(AD-734359; RIAS-TR-71-25C) Avail: NTIS CSCL 20/4

The study of three-dimensional boundary layers is synonymous with the study of cross flow or streamwise vorticity in the boundary layer. The research is concerned with the initial value problem for the 3-D boundary layer equations. Results are reported on exact solutions for the decay of streamwise vorticity, on a combined oil-flow--optical method of visualizing the surface flow field in the presence of 3D protuberances, and nonuniform behavior of the small crossflow approximation.
GRA

N72-19334# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
SINGULAR PERTURBATION AND TURBULENT SHEAR FLOW NEAR WALLS
Francis E. Fendell (TRW Sys. Group, Redondo Beach, Calif.) Nov. 1971 60 p refs
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. Squid)
(AD-734156; SQUID-TR-TRW-1-PU) Avail: NTIS CSCL 20/4

The method of matched asymptotic expansions is applied to fully turbulent shear flow near walls in the limit of an appropriately defined Reynolds number tending to infinity. In particular, turbulent pipe/channel flow and boundary-layer flow on a flat plate with an external pressure gradient upstream of

any separation is examined. The relevant Reynolds number is the ratio of the turbulent stress to the Newtonian stress. For the postulated expansions, the logarithmic profile, wall friction law, and classical similarity results are deduced without an explicit closure condition relating the turbulent stress to the Newtonian stress. Continuation to higher order is shown to be in general indeterminate without additional physical input to the formulation. Author (GRA)

N72-19335# Texas Univ., Austin. Applied Research Labs.
TESTS OF VORTEX GENERATORS TO PREVENT SEPARATION OF SUPERSONIC FLOW IN A COMPRESSION CORNER
David K. Gartling Dec. 1970 81 p refs Sponsored in part by Navy Prepared in cooperation with Johns Hopkins Univ., Baltimore
(AD-734154; ARL-TR-70-44) Avail: NTIS CSCL 20/4

Tests were made on four vortex generators to determine their ability to prevent flow separation. The generators were of rectangular planform with chord lengths of 0.5 and 1.0 in. and spans of 0.25 and 0.50 in. Generator section shape was a symmetric double wedge. The generators were individually mounted at a 15 deg angle of attack on a flat plate upstream of a 35 deg compression corner. The tests were made in a wind tunnel at an average Mach number of 4.67. The boundary layer was turbulent and approximately 1/4 in. thick at the test station. State pressure measurements were taken along the centerline of the plate and on the ramp face. Oil and dye flows and schlieren photographs were used to aid in determining the extent of separation. GRA

N72-19336# Naval Ship Research and Development Center, Bethesda, Md.
LOCATION OF SEPARATION ON A CIRCULAR CYLINDER IN CROSSFLOW AS A FUNCTION OF REYNOLDS NUMBER
David W. Coder Nov. 1971 34 p refs
(Proj. S4611-010)
(AD-733983; NSRDC-3647) Avail: NTIS CSCL 20/4

All available information on the location of separation on a circular cylinder in crossflow as a function of Reynolds number, from creeping flow to transcritical flow, has been summarized. The results of an experiment by the author in the transition or supercritical flow regime are included. The various theoretical and experimental results are discussed and compared. Areas needing additional theoretical and experimental work are pointed out. GRA

N72-19337# Nielsen Engineering and Research, Inc., Mountain View, Calif.
THEORETICAL ANALYSIS OF CYCLOIDAL PROPELLERS Final Report, 1 May 1970 - 31 Jul. 1971
Michael R. Mendenhall and Selden B. Spangler Jul. 1971 70 p refs
(Contract N00014-70-C-0346; SR-Proj. 009-01-01; NEAR Proj. 168/C)
(AD-734019; NEAR-TR-33) Avail: NTIS CSCL 13/10

An inviscid, two dimensional, theoretical analysis was made of a vertical axis propeller in order to predict its performance in a uniform flow. The propeller characteristics required are the number of blades, the blade chord and camber, the propeller radius, and the blade angle variation with angular position of the blade around the propeller disk. The flow condition required is the advance ratio. A detailed description of blade wakes is developed in order to obtain blade-wake interference as related to blade loading, blade angle of attack, blade circulation, and propeller side force, thrust and torque. Average values of propeller forces and torque are predicted. GRA

N72-19338# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
CORRELATION OF NOISE AND FLOW OF A JET
Hie K. Lee Aug. 1971 89 p refs Sponsored in part by NRC of Can.
(Grant AF-AFOSR-1885-70; AF Proj. 9781)
(AD-734042; UTIAS-168; AFOSR-71-2572TR) Avail: NTIS CSCL 20/1

Two approaches have been tried to develop and apply a new method for experimentally estimating, at a far field position, the spectra and intensity of noise originating from unit volume of a round jet, extending to 7 D downstream. Cross-correlation between their filtered narrow-band counterparts, approach 2, has been developed and exploited. The measurements were analyzed via Proudman's form of Lighthill's integral further manipulated to apply to the approaches mentioned. The results showed qualitative agreement with some of the earlier theoretical predictions made by Ribner and by Powell. GRA

N72-19339# Naval Postgraduate School, Monterey, Calif.
THE ANALYTICAL TREATMENT OF SECONDARY FLOWS AND ASSOCIATED LOSSES IN AXIAL FLOW TURBOMACHINES
James R. Woods, Jr. 10 Dec. 1971 39 p refs
(AD-734983; NPS-57W071121A) Avail: NTIS CSCL 20/4

The report presents the current state of the art of the analytical treatment of secondary flows and associated losses in axial-flow turbomachines. A physical description of the secondary-flow phenomena is given, as well as the theoretical methods that are available to treat secondary flows and to predict secondary losses. GRA

N72-19340# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A HYPERSONIC GAS STREAM FLOWING AROUND CONICAL SOLIDS WHICH ARE SLIGHTLY DIFFERENT FROM ROUND CONES
Ya. G. Sapunkov 4 Nov. 1971 17 p ref Transl. into ENGLISH from Transzvukovye Techeniya Gaza (USSR), no. 2, 1968 p 114-127
(AD-734907; FTD-MT-24-1554-71) Avail: NTIS CSCL 20/4

The method suggested for isolating an anomaly in the eddy layer close to the surface of a cone with a supersonic stream flowing around it under an angle of attack is used to solve the problem of flow around a conical solid which is slightly different from a rounded cone. The solution appears accurate for smallnesses of the first order, uniformly approximating the solution in the entire disturbance region. The solution was obtained in the form of quadratures. GRA

N72-19341# Texas Univ., Austin. Applied Research Labs.
SKIN FRICTION AND HEAT TRANSFER IN TURBULENT BOUNDARY LAYERS AS INFLUENCED BY ROUGHNESS, PART 1 Final Report, 1 Mar. 1968 - 31 Dec. 1970
Milton J. Thompson 17 Dec. 1970 99 p refs Sponsored in part by Naval Air Sys. Command Prepared for APL
(Contract APL/JHU-271734)
(AD-734152; ARL-TR-70-43-Pt-1) Avail: NTIS CSCL 20/4

The report provides a summary of theoretical and experimental research on turbulent boundary layers under supersonic free stream conditions. The program included investigations of boundary layer behavior at various Mach Numbers for smooth, adiabatic surfaces, various types of surface roughness, and the combined effects of roughness and heat transfer. The experimental program involved velocity profile measurements and the momentum deficit method of calculating skin friction, determinations of local shear stress values, and the utilization of plug-type calorimeters for determinations of heat transfer rates. GRA

N72-19342# Texas Univ., Austin. Applied Research Labs.
PROTUBERANCE AND VORTEX GENERATOR STUDIES AT ARL, PART 2 Final Report, 1 Mar. 1968 - 31 Dec. 1970
John C. Westkaemper 25 Jan. 1971 41 p refs Sponsored in part by Naval Air Sys. Command Prepared for APL

(Contract APL/JHU-271734)
(AD-734153; ARL-TR-70-43-Pt-2) Avail: NTIS CSCL 20/4

The report describes a program of research on the aerodynamics of protuberances in supersonic flow. The research included a variety of sizes of circular cylinders mounted on a flat plate having a turbulent boundary layer; both single and multiple cylinder patterns were studied. The results included data for Mach Numbers of 2.0 and 5.0. Study was directed toward the use of vane-type vortex generators to delay the separation of turbulent, supersonic boundary layers. GRA

N72-19343# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF FLUIDIC ELEMENTS AND SYSTEMS FOR AIRCRAFT, MISSILES AND SPACECRAFTS
Knezevic Dragutin 19 Oct. 1971 18 p refs Transl. into ENGLISH from Nauchn.-Tehnicki Pregled (Yugoslavia), v. 20, no. 3, 1970 p 27-34
(AF Proj. 1256)
(AD-734715; FTD-HC-23-1038-71) Avail: NTIS CSCL 13/7

Pneumatic automation technology showed a significant step forward during the recent years. A turning point in this control technique was reached in 1959/60, when the pneumo- automatic principle using elements without moving mechanical parts and based on the reciprocal hydroaerodynamic action of the operating fluid passing through fixed lines, was applied for the first time. This new technology is identified today as fluidics, or, in the systems where air functions as the operating agent, as pneumonics. The article deals with the application of fluidic (pneumonic) elements and systems in craft which responds most readily to the new technology, i.e., in aircraft, missiles and spacecraft. Author (GRA)

N72-19344# Hydronautics, Inc., Laurel, Md.
DIFFRACTION OF SURFACE WAVES BY A SUBMERGED BODY IN MOTION
Peter Van Dyke and Willem P. A. Joosen Sep. 1971 38 p refs
(Contract N00014-70-C-0345; NR Proj. 220-016)
(AD-735093; TR-231-20) Avail: NTIS CSCL 20/4

Surface waves at the water surface are influenced locally by a submerged moving slender body. In addition to the Kelvin wave pattern which would be created by the moving body when travelling at uniform speed under smooth water, waves on the surface can be diffracted; this report is concerned with the diffraction effect. It is assumed that a linearized theory can be applied, and that using slender body theory, relative wave heights can be evaluated. For the coincident wave-body direction case, approximate expressions for the results are obtained for three particular ranges of the encounter frequency and body velocity parameters GRA

N72-19345# Harry Diamond Labs., Washington, D.C.
ION AND ELECTRON DISTRIBUTIONS IN THE BOUNDARY LAYER OF HYPERSONIC VEHICLES FOR CHEMICAL NONEQUILIBRIUM FLOW. PART 2: METHOD OF SOLUTION AND COMPUTER PROGRAM
Arthur Hausner Nov. 1971 40 p refs
(DA Proj. 1T0-61101-A-91-A)
(AD-734892; HDL-TR-1567-Pt-2) Avail: NTIS CSCL 16/3

A study has been made of ion-electron distributions for a hypersonic vehicle with a 10-degree semivertex, sharply pointed cone at Mach 8 and 10 for sea-level flight. The report is concerned specifically with computational aspects of the ion-electron-distribution equations involved. The equations to be solved are presented to describe the transformations required to simplify their numerical solution. The computational aspects include: transformations to simplify the solutions of the equations; linearization of the equations to permit use of matrix methods, derivation of small-value, asymptotic solutions, and a computer program GRA

N72-19346# ARO, Inc., Arnold Air Force Station, Tenn.
IMPLICIT FINITE DIFFERENCE ANALYSIS OF COMPRESSIBLE LAMINAR, TRANSITIONAL, AND TURBULENT BOUNDARY LAYERS ALONG THE WINDWARD STREAMLINE OF A SHARP CONE AT INCIDENCE Final Report, Jul. 1970 - Jun. 1971
John C. Adams, Jr. AEDC Dec. 1971 101 p refs
(Contract F40600-72-C-0003)
(AD-734535; AEDC-TR-71-235; ARO-VKF-TR-71-48) Avail: NTIS CSCL 20/4

Formulation and application of a windward plane of symmetry laminar, transitional, and turbulent boundary-layer analysis is presented for sharp cones at incidence in a supersonic or hypersonic flow. The governing boundary-layer equations in the plane of symmetry are numerically integrated on a digital computer using a marching implicit finite-difference technique. A so-called invariant model of turbulence is used in a two-layer eddy viscosity-mixing length approach for calculation of the turbulent boundary layer in conjunction with an intermittency factor treatment of the transition zone. Comparison of the present theory with experimental data is made. GRA

N72-19347# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE FLOW NEAR THE TIP AND WAKE EDGE OF A LIFTING WING WITH TRAILING EDGE SEPARATION
J. Rom and H. Portnoy Aug. 1971 42 p refs
(Grant AF-AFOSR-2145-71; AF Proj. 9781)
(AD-734791; TAE-132; AFOSR-72-0010TR; SR-1) Avail: NTIS CSCL 20/4

A method is presented for improving the linearized solution for the flow near the tips and wake edges of a lifting wing in incompressible flow, mainly with a view to its more effective utilization in the calculation of the rolling up of the trailing vortex wake. The treatment takes account of the actual or, in the case of the wake, effective radius of the edge by the method of matched asymptotic expansions. The result is presented as an integral for the perturbation potential which is uniformly valid to first approximation in all parts of the flow field about the wing and close behind the trailing edge GRA

N72-19348# Aerotherm Corp., Mountain View, Calif.
A TURBULENT MODEL STUDY FOR THE MULTICOMPONENT NONSIMILAR TURBULENT BOUNDARY LAYER PROGRAM Technical Report, May 1970 - Mar. 1971
Larry W. Anderson and Howard L. Morse Oct. 1971 208 p refs
(Contract F29601-70-C-0055; Af Proj. 5791)
(AD-734752; AFWL-TR-71-57) Avail: NTIS CSCL 20/4

An investigation of the accuracy of the Air Force Weapons Laboratory Nonsimilar Turbulent Boundary Layer Computer Code through comparisons of predictions with experimental data is presented. Five complete data sets are selected from a literature survey of flat plate supersonic flow, hypersonic flow with and without accerleration, supersonic flow with highly nonsimilar wall temperature wall blowing. Comparisons are presented which include velocity, total temperature, and Mach number profiles at several axial stations GRA

N72-19349# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
INTERACTION OF THE CORNER OF INTERSECTING WEDGES AT A MACH NUMBER OF 3 AND HIGH REYNOLDS NUMBERS Final Report
John E. West and Robert H. Korkegi Oct. 1971 41 p refs
(AF Proj. 7064)
(AD-734540; ARL-71-0241) Avail: NTIS CSCL 20/4

The flow structure was determined in the streamwise corner formed by two intersecting wedges of 9 1/2-degree half angle in a supersonic stream at a Mach number of 3 and over a Reynolds number range from 40000 to 6 x 10 to the 7th power. Measurements included Pitot traverses, surface pressures, and oil flow visualization. For Reynolds numbers below 3000000 the

wedge boundary layer was studied as laminar and transitional, with the corner interaction initially extended laterally well beyond the embedded shock. Spanwise surface pressure distributions for both the laminar and the turbulent cases are compared to those for two-dimensional flow separation. GRA

N72-19350# Naval Ordnance Lab., White Oak, Md.
THE PREDICTION OF TURBULENT BOUNDARY-LAYER SEPARATION INFLUENCED BY BLOWING
Arnold Polak 21 Jul. 1971 27 p refs
(NOL Proj. 800/AF-PR3-31)
(AD-734647; NOLTR-71-125) Avail: NTIS CSCL 20/4

The report presents an analysis predicting separation of a turbulent boundary layer over a cone-flare configuration with gas injected into the boundary layer ahead of separation point. Separation location and separation lengths are compared with experimental data obtained at Mach number of 6 and a range of Reynolds numbers. At the highest Reynolds numbers the extent of separation decreases with increasing Reynolds number. When compared to separation over cylinder-flare body it is found that the extent of separation is lower for the cone-flare configuration. Author (GRA)

N72-19351# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DUST COLLECTION EFFICIENCY FOR POWER LAW IN HYPERSONIC FLIGHT
Joseph H. Spurk and Nathan Gerber Nov. 1971 39 p refs
(DA Proj. 1T0-61101-A-91-A)
(AD-734875; BRL-1554) Avail: NTIS CSCL 20/4

A numerical and analytical study predicts (i) the collection efficiency of conical and blunted axisymmetric bodies of the power law family in hypersonic flight through dust clouds, and (ii) the impact angle and velocity. Collection efficiencies of cones using the exact conical flow field solutions are shown for particles obeying a particular dray law. most of the data can be correlated by three dimensionless groups. Results show large variations from collection efficiency based on the less realistic standard drag laws Drag coefficient. Collection efficiency of power law bodies has been determined in the hypersonic slender body approximation for the realistic drag law. An approximate model provides a qualitative description of the collection efficiency and impact angle dependence on the main parameters. GRA

N72-19352# Naval Postgraduate School, Monterey, Calif.
RECIRCULATORY FLOW VISUALIZATION IN HELICOPTER FLIGHT MODES M.S. Thesis
Arthur William Nelson, III Sep. 1971 34 p refs
(AD-734873) Avail: NTIS CSCL 20/4

The classical working states of the aircrew were studied employing the three-dimensional flow visualization tunnel at the Naval Postgraduate School, Monterey, California. The various states were simulated in an attempt to gain insight into some of the present problem in helicopter rotor design. This method was extended to include two particular phenomena, the critical part of the vortex ring state and Mangler's distribution of induced velocity about a rotor in the helicopter mode. Using a feasible distribution ascertained from the flow visualization, the induced velocity distribution was calculated for several points in the vortex ring state. Author (GRA)

N72-19424# Michigan State Univ., East Lansing.
TURBULENCE AND REFRACTIVITY CHANGES AND THEIR SENSING BASED UPON THE WAVE MECHANICS THEORY
M. Z. V. Krzywoblocki *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-19353 National Lending Library for Science and Technology, Boston Spa (England).
TIME CORRELATIONS OF THE WIND FIELD IN THE TROPOSPHERE AND STRATOSPHERE
N. Z. Pinus and V. A. Snajdman [1970] 8 p refs Transl. into ENGLISH from Cent. Aerol. Obs. (Moscow), v. 97, 1970 p 63-71
(NLL-M-22051-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The variability of meteorological fields in time is discussed using data from radiosonde ascents over Har'kov. Time autocorrelation functions are given for the zonal and meridional wind components at different levels for periods of 48, 96, and 192 hours, and also of the mean for the whole sample. E.H.W.

N72-19354# Danish Meteorological Inst., Charlottenlund.
THULE GEOPHYSICAL OBSERVATORY MAGNETIC RESULTS, 1964
1971 57 p refs
(ISBN-87-7478-042-5) Avail: NTIS

Hourly magnetic observations conducted by the geophysical observatory at Thule, Greenland are presented. Readings were taken during 1964. Regular recording of the three magnetic elements H, D, and Z were taken by means of three sets of photographic variometers. All variometers are of the La Cour type without damping. Author

N72-19355# Danish Meteorological Inst., Charlottenlund.
THULE GEOPHYSICAL OBSERVATORY MAGNETIC RESULTS, 1963
1971 36 p refs
(ISBN-87-7478-030-1) Avail: NTIS

Hourly magnetic observations conducted by the geophysical observatory at Thule, Greenland are presented. Readings were taken during 1963. Regular recording of the three magnetic elements H, D, and Z were taken by means of three sets of photographic variometers. All variometers are of the La Cour type without damping. Author

N72-19356*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
BASIC RESEARCH AND DATA ANALYSIS FOR THE NATIONAL GEODETIC SATELLITE PROGRAM Semiannual Status Report, Jul. - Dec. 1971
Jan. 1972 68 p refs
(Grant NGL-36-008-093; OSURF Proj. 2514)
(NASA-CR-125687; SASR-9) Avail: NTIS CSCL 08G

Investigations of triangulation nets and scaling are reported. Adjustment of the BC-4 worldwide geometric satellite triangulation net is described, along with procedures for correcting type II data and the contents of magnetic tapes containing data from the Pageos network. Computational steps for the further reduction of partially reduced satellite image plate coordinates are outlined. The problem of improving existing triangulation systems by means of satellite super-control points was studied. The SAO-69 geometric solution was scaled with C-band radar data, resulting in SAO and C-band adjustment compatible with one another in the Western Hemisphere. The North America solution NA-6, obtained from GEOS 1 data, was readjusted with new heights as constraints on all 30 optical stations and is referred to as the NA-8 solution. N.E.N.

N72-19357# National Center for Atmospheric Research, Boulder, Colo.
PARTICULATE MODELS: THEIR VALIDITY AND APPLICATION
I. H. Blifford, Jr., ed. Aug. 1971 290 p refs Workshop held at Boulder, Colo, 21 Aug. 1970 Sponsored by NSF (NCAR-TN/PROC-68) Avail: NTIS

The aim of formulating more realistic models of atmospheric particulates is pursued by studying various aerosol measurement techniques, the formations of theoretical aerosol and hydrometeor models, and by analyzing the optical properties of upper and lower atmospheric aerosols. The emphasis is on air pollution. For individual titles, see N72-19358 through N72-19380.

N72-19358# Minnesota Univ., Minneapolis.
AEROSOL MEASUREMENTS: NEW DATA ON URBAN AEROSOLS AND FORMATION MECHANISMS
Kenneth T. Whitby *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 3-12 ref (See N72-19357 10-13) Avail: NTIS

Photochemical and chemical formation of aerosols at very small sizes constitutes a significant part in the volume density distribution of Los Angeles smog. Mass median diameters for these smog aersosols are as small as 0.2 millimicrons with mass concentrations over 100 microgram/cu cm. It is concluded that about 50 to 75% of the aerosol is a volatile liquid, presumably water. There appears to be significant chemical formation of aerosols at night because most of the aerosol mass in the smog results from coagulation and condensation of very small chemically formed aerosols. G.G.

N72-19359# Old Dominion Univ., Norfolk, Va. Dept. of Chemistry.
ATMOSPHERIC AEROSOL MEASUREMENTS
F. S. Harris, Jr. *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 13-20 (See N72-19357 10-13) Avail: NTIS

A portable aerosol measurement system is described that uses small angle scattering, a photomultiplier converter, and computerized data processing to obtain particle size distributions from several locations in air pollution monitoring. G.G.

N72-19360# National Center for Atmospheric Research, Boulder, Colo.
CHEMICAL COMPOSITION OF ATMOSPHERIC AEROSOLS
Dale Gillette *In its* Particulate Models: Their Validity and Appl. Aug. 1971 p 21-26 (See N72-19357 10-13) Avail: NTIS

Several chemical aerosol constituents were analyzed by X-ray fluorescence, colorimetric techniques, and flame emission spectrophotometry. Measured chemical elements were chlorine, sulfur, potassium, sodium, silicon, calcium, and titanium. Examination of the mass ratios of these elements showed that titanium, calcium, and potassium formed very constant ratios to silicon with respect to altitude and location. The values of mass ratios tend toward the standard values for the earth's crust. G.G.

N72-19361# Max-Planck-Institut fuer Chemie, Mainz (West Germany).
SURVEY OF WORK AT MAINZ ON AEROSOL SIZE DISTRIBUTION
R. Jaenicke *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 27-30 (See N72-19357 10-13) Avail: NTIS

Unpolluted aerosol size distribution measurements are reported for continental air as well as for maritime air by condensation nucleus counter, Royco optical counter, and double stage-, ordinary-, and rotating-impactors. Although size distributions from the various instruments fit well together, large deviations in the Aitken particle range distribution are observed. The overall shape of this distribution shows high values in the radius interval 10 to the minus seven power to 3 x 10 to the minus seven power cm that are attributed to a dynamic equilibrium in production and coagulation of particles. G.G.

N72-19362# National Center for Atmospheric Research, Boulder, Colo.
MODELS OF ATMOSPHERIC AEROSOLS DERIVED FROM MEASUREMENTS
John J. DeLuisi *In its* Particulate Models: Their Validity and Appl. Aug. 1971 p 31-36 (See N72-19357 10-13) Avail: NTIS

Standard aerosol size distributions are derived from measurement data by finding the linear regression coefficients that express the value dN/d(log r) as a function of the total integrated number beneath the size distribution curves measured for a certain range. At each of about 40 radius intervals for a given total integrated number N, the value dN/d(log r) for the ith interval is found by dN/d(log r) = a sub iN + b sub i. Uppermost curves represent low level aerosols and high number densities; their variation with location is more marked than in the high level curves. Assumptions to correct for Mie scattering effects are included. G.G.

N72-19363# North American Rockwell Corp., Downey, Calif. Science Center.
THEORETICAL MODELS FOR AEROSOL BEHAVIOR
G. M. Hidy *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 45-60 refs (See N72-19357 10-13) Avail: NTIS

The development of stochastic and deterministic models for predicting aerosol size distribution functions is considered. The stochastic method constitutes computations emphasizing collisions of particles, or a purely random process is assumed with the ultimate distribution function at equilibrium. The deterministic theory employs a kinetic equation whose solution yields the size spectrum and where turbulent diffusion is an important transport term. G.G.

N72-19364# National Center for Atmospheric Research, Boulder, Colo.
GLOBAL AEROSOL MODEL
Irving H. Blifford, Jr. *In its* Particulate Models: Their Validity and Appl. Aug. 1971 p 61-65 refs (See N72-19357 10-13) Avail: NTIS

The modified Junge global steady state aerosol model is outlined. The aerosol is considered to consist of a fraction that is outside of clouds and a fraction that is within the clouds. The finite difference terms for the fraction outside the clouds take into account photo-oxidation of SO2 at the surface of the particle or other chemical reactions that may be proportional to the surface area of the particle; also included are washout, sedimentation, and attachment to objects in the airstream. The second part of the model describes the fraction of the aerosol within the clouds and considers condensation, coagulation, and heterogeneous gas reactions. G.G.

N72-19365# Arizona Univ., Tucson. Inst. of Atmospheric Physics.
SCATTERING PROPERTIES OF AEROSOLS
B. M. Herman *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 75-80 (See N72-19357 10-13) Avail: NTIS

Optical scattering properties of aerosols and their effects on atmospheric radiation transfer in both the infrared and visible spectrum are discussed. Theoretical calculations and polarization measurements illustrate that irregular particles do not scatter light in the same way as spherical particles and that the dispersion system used in these measurements generates a scattering medium whose Mueller matrix exhibits the properties of an isotropic symmetric medium. G.G.

N72-19366*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

SCATTERING BY IRREGULAR PARTICLES

A. C. Holland *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 81-91 ref (See N72-19357 10-13)

(NASA-TM-X-67648) Avail: NTIS CSCL 04A

Compared are the scattering properties of irregular, randomly oriented particles with those calculated for homogeneous spheres that fit the same distribution function and have the same refractive index. Also compiled is a sufficient amount of experimental data with which to evaluate or to develop better theoretical models of the scattering properties of real aerosols.

Author

N72-19367# Colorado State Univ., Fort Collins.

SLANT PATH RADIATION THROUGH HAZE LAYERS

William E. Marlatt *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 93-104 (See N72-19357 10-13)

Avail: NTIS

To determine radiative transfer through haze layers, a series of profile measurements were made by aircraft instrumented with a spectrometer, aerosol and nucleus counters, upward- and downward-viewing pyranometers, tracking camera, downward viewing 8 to 12 micron radiometer, and a MRIR radiometer mounted to view upward for horizon to horizon scanning. Angular distributions for two wavelength ranges over Colorado and over Houston revealed that the total accumulation of particles in a column of 1 sq ft extending from the surface to 16,000 ft over Houston is nearly 150 times that over eastern Colorado. Attenuation of sky radiation as a function of slant path is determined by comparison of MRIR measurements above and below the haze layer with those calculated by the Cox-Kuhn computer model for radiation transfer. G.G.

N72-19368# Stanford Research Inst., Menlo Park, Calif.

LIDAR AND AEROSOL STUDIES AT SRI

Edward E. Uthe *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 105-114 (See N72-19357 10-13)

Avail: NTIS

Lidar signatures taken by aircraft are digitized and computer processed into cross sections of relative scattering. Readily identified atmospheric features are haze layers, a well mixed sub-cloud layer, and clouds. A definite relationship is derived from infrared transmissions and the thickness of cirrus clouds, as observed by lidar signatures. The intensity of aircraft recorded turbulence is related to lidar observed aerosol discontinuities in the rotor region. G.G.

N72-19369# Xerox, Rochester, N.Y.

POLYCHROMATIC LASER AEROSOL SIZING AND RANGING (PLASAR) SYSTEM

L. W. Carrier *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 115-118 ref (See N72-19357 10-13)

Avail: NTIS

A proposed polychromatic laser aerosol sizing and ranging (PLASAR) system and a technique for the remote determination of particle size distributions and for mapping atmospheric particulates are briefly described. The system is somewhat similar to the bistatic lidar system; however a major difference in the technique is that instead of simply obtaining a ratio of the scattering functions in the plane of observation and perpendicular to the plane of observation as a function of scattering angle, the scattering ratio is obtained as a function of wavelength. The method of determining size distributions of atmospheric particulates is based upon an optical inversion technique that has been demonstrated to apply to particulates suspended in water. Author

N72-19370# Wisconsin Univ., Madison.

MEASUREMENTS IN THE INFRARED OF OPTICAL CONSTANTS OF SOME PROBABLE STRATOSPHERIC AEROSOL CONSTITUENTS

E. Remsberg *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 119-128 (See N72-19357 10-13)

Avail: NTIS

The radiative properties of sulfuric aerosols in solution with water are determined by attenuated total reflection spectroscopy. Ray diagrams show that total reflection is achieved whenever the angle of incidence is greater than some critical angle defined by $\sin/1(n \text{ sub } 2/n \text{ sub } 1)$. Complex infrared index of refraction data for 68% nitric acid show a peak at about 10.5 millimicrons; similar data are obtained for a nearly saturated solution of 39 percent ammonium sulfate. These data are taken from bulk solution samples at room temperature. G.G.

N72-19371# National Security Agency, Fort Meade, Md.

OPTICAL CONSTANTS OF WATER PARTICULATES FOR WAVELENGTHS IN THE VISIBLE AND INFRARED c23

G. D. Lukes *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 129-158 refs (See N72-19357 10-13)

Avail: NTIS

The transmission of radiant energy through hazy, foggy, cloudy, and rainy atmospheres is determined by the number concentration per unit volume of droplets and the wavelength of energy actually transmitted, as well as the real refractive index and the absorptive index of liquid water as a function of wavelength. The complex index of refraction of liquid water as a function of wavelength for the wavelength range from 0.1 millimicrons to 10 cm has been applied for modeling six types of water clouds: altostratus, stratus, stratocumulus, fair weather cumulus, nimbostratus, and cumulus congestus. Author

N72-19372# National Center for Atmospheric Research, Boulder, Colo.

SURVEY OF EXPERIMENTAL WORK IN HYDROMETEORS c14

J. Doyne Sartor *In its* Particulate Models: Their Validity and Appl. Aug. 1971 p 167-174 (See N72-19357 10-13)

Avail: NTIS

A survey on available data on drop distributions in various cloud formations shows that no general distribution function fits cloud drop or raindrop spectra. The cloud type, air mass, cloud position, and temperature must all be considered. It is recommended to choose a droplet distribution function for applied problems requiring droplet size and concentration and to make relative comparisons with other distributions. This makes it possible to avoid the dependence on data that are not really representative of the cloud itself. G.G.

N72-19373# National Center for Atmospheric Research, Boulder, Colo.

NUMERICAL CLOUD MODELS c20

R. L. Drake *In its* Particulate Models: Their Validity and Appl. Aug. 1971 p 175-177 (See N72-19357 10-13)

Avail: NTIS

Numerical cloud models are classified according to their dimensionality in space. Thunderstorm and severe storm models are three dimensional and time dependent; one dimensional models represent the microphysics of clouds; and two dimensional models are used for cloud formations due to lifting over mountains. G.G.

N72-19374# Denver Univ., Colo.

CLOUD PHYSICS STUDIES AT THE DENVER RESEARCH INSTITUTE c20

N. Fukuta *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 179-183 refs (See N72-19357 10-13)

Avail: NTIS

Work reported centered on the theoretical development of hydrometeor growth. It is found that contact nucleation involves the destruction of active sites and that the ice nucleus jet formation in a direct current field is a multiple-step process. A spherical model for the kinetics of hydrometeor growth is developed that consists of a growing spherical water drop where

the water vapor diffuses onto the surface through the flux tube and the boundary of the vapor and heat exchange is at approximately one mean free path from the surface. The released latent heat at the surface escapes through the boundary and then to space through the same flux tube. Thus, the differential equation for pure water droplets includes the effect of the boundary layer. G.G.

N72-19375# Meteorology Research, Inc., Altadena, Calif.
HYDROMETERS IN SUMMER CLOUDS c14
A. J. Alkezweeny *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 185-189 *ref* (See N72-19357 10-13)
Avail: NTIS

The cloud droplet and rain droplet size distributions were studied from convective summer clouds. The cloud droplet distributions were taken from the MRI continuous particle collector mounted on an aircraft, and have been corrected for the collection efficiency of the collector. The percentage of a given size of drops is given as a function of drop diameter for different levels in the cloud. At the higher levels in the cloud, the peak in the distribution shifted toward the larger sizes and distribution broadened, eventually producing a distribution with two peaks, more or less. Average drop sizes are plotted as a function of height for the same cloud. The points are widely scattered around a fitted straight line. Author

N72-19376# Air Force Cambridge Research Labs., Bedford, Mass.
DROP SIZE MEASUREMENTS IN LOW-LEVEL STRATUS c20
J. E. A. Selby *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 191-196 refs (See N72-19357 10-13)
Avail: NTIS

Gas laser attenuation in clouds and simultaneous measurements of cloud drop size distribution are used to investigate the correlation between visual range and visible and infrared attenuation. Measurements in the lower 30 to 60 m of stratus clouds of drop samples found two types of distributions: one exhibited a sharp peak at about 2 millimicrons and the other was a wider distribution with some biomodal maxima at about 1.5 and 4 millimicron radius, containing about 250 drops/cu cm. The radii of the measured droplets were in the range of 0.8 to 17 millimicrons. Calculated attenuations based on drop size measurements generally agree with measured attenuation values within a factor of two. G.G.

N72-19377# Environmental Science Services Administration, Washington, D.C.
SURVEY OF STRATOSPHERIC AEROSOL MEASUREMENTS
F. F. Hall, Jr. *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 203-219 refs (See N72-19357 10-13)
Avail: NTIS

A brief summary of some stratospheric aerosol measurement techniques is given ranging from indirect probes to aircraft and balloon studies that include lidar. Recent spectral measurements on tropospheric particles produced by jet aircraft indicate mean particulate sizes from 0.1 to 0.2 millimicrons in diameter. Since about 10.1% of all jet fuel burned is exhausted as particulate matter, this represents a considerable accumulation comparable to the natural aerosol background measured in the 6- to 12-km region of the upper atmosphere over the continental United States. G.G.

N72-19378# National Center for Atmospheric Research, Boulder, Colo.
CHEMICAL COMPOSITION OF STRATOSPHERIC AEROSOLS
J. P. Shedlovsky *In its* Particulate Models: Their Validity and Appl. Aug. 1971 p 221-226 refs (See N72-19357 10-13)
Avail: NTIS

Analysis of a number of stratospheric samples at mid- and equatorial-latitudes do not show significant variations in the sulfate mixing ratio. The Cl/Br average ratio of stratospheric aerosols in nine samples is 20 plus or minus 2, whereas the value for this ratio is about 300 in sea salt and about 70 in crustal rocks. Chlorine and bromine ratio measurements in tropospheric aerosols (resulting from leaded gasolines) over Nebraska, Death Valley, and 200 km off the coast of California ranged between 10 and 100. G.G.

N72-19379# Wisconsin Univ., Madison.
GLOBAL DISTRIBUTION OF STRATOSPHERIC AEROSOLS AS DERIVED FROM BALLOON-BORNE INFRARED FLUX MEASUREMENTS
S. Pilipowskyj and J. Weinman *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 227-236 refs (See N72-19357 10-13)
Avail: NTIS

Analyses of the records of 400 radiometric stratospheric aerosol measurements during balloon ascents indicate that there are more aerosols in the tropic than in the northern latitudes. Since most of the aerosol exists where temperatures are low, it is shown that aerosol distribution is affected by the more severe temperature gradients during winter in the tropical regions as compared with the milder gradients in the polar stratosphere. It is concluded that low temperatures affect aerosol distribution in global stratosphere. G.G.

N72-19380*# Old Dominion Univ., Norfolk, Va. Dept. of Chemistry.
A BIBLIOGRAPHY ON ATMOSPHERIC PARTICULATES
F. S. Harris, Jr. *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 256-294 refs (See N72-19357 10-13)
(Contract NAS1-9434-28)
(NASA-CR-125857) Avail: NTIS CSCL 04A

This bibliography covers a wide variety of studies on atmospheric particulates and includes lidar techniques and measurements of hydrometeors. In most cases inclusive pagination is given. G.G.

N72-19381# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
HELENA VALLEY, MONTANA, AREA ENVIRONMENTAL POLLUTION STUDY
Jan. 1972 191 p refs
(AP-91) Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

The investigation concerned contamination of the environment by arsenic, cadmium, lead, zinc, and sulfur dioxide from the industrial smelting complex in the city of East Helena. For individual titles, see N72-19382 through N72-19392.

N72-19382# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
HELENA VALLEY, MONTANA, AREA ENVIRONMENTAL POLLUTION STUDY: SUMMARY
In its Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 1-24 (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

Atmospheric concentrations of sulfur dioxide in the Helena Valley exceed Montana air quality standards, and the levels reported in Federal criteria are associated with deleterious effects on human health, vegetation, and materials. Industrial operations of American Smelting and Refining Company and Anaconda Company in East Helena are the responsible sources. Air, water, and soil in the Valley are contaminated with heavy metals from the East Helena smelting complex. Water in Prickly Pear Creek is contaminated, as well as soil and vegetation which absorb arsenic, cadmium, and lead as air pollutants to a level toxic to

grazing farm animals. Evidence indicates that subclinical effects could be occurring in humans. Threshold limits were established for industrial exposure of healthy adults for eight hours per day, 40 hours per week, during a normal working life. Emission control methods, pollution information dissemination, and protective measures are discussed. Author

N72-19383# Environmental Protection Agency, Research Triangle Park, N.C. Region 8 Office.
SURVEY OF AIRBORNE POLLUTANTS c20
Norman A. Huey *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 25-60 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

The pollutants surveyed were sulfur dioxide, airborne particulates, arsenic, cadmium, lead, and zinc. All measurements were made between June and November 1969, except for sulfation measurements, which were continued until June 1970. Sulfur dioxide was measured with continuous monitors at 5 locations and with sulfation plates at approximately 200 locations. Measurements related to sulfur dioxide pollution, i.e. sulfate and total acidity, were also made on suspended particulates. Total suspended and total settleable particulates (dustfall) were measured at 5 locations; windblown particulates and soiling index were measured at 40 and 4 locations, respectively. Arsenic, cadmium, lead, and zinc contents were determined in suspended and settleable particulates. Ozone and nitrogen oxides were measured by continuous monitors for brief periods of time at one or two locations in conjunction with the vegetation effect investigations. Author

N72-19384# Environmental Protection Agency, Research Triangle Park, N.C. Office of Water Programs.
SURVEY OF WATER QUALITY
Albert V. Soukup *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1971 p 61-63 ref (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

The results are presented for a water analysis made by the Region 8 Bureau of Water Hygiene, Public Health Service. The chemical constituents of all drinking and irrigation waters in the Helena Valley area were investigated. Author

N72-19385# Geological Survey, Washington, D.C.
ABUNDANCE AND DISTRIBUTION OF LEAD, ZINC, CADMIUM, AND ARSENIC IN SOILS
A. T. Miesch and Claude Huffman, Jr. *In* Environ. Protection Agency Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 65-80 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

An investigation of the abundance and distribution of lead, zinc, cadmium, and arsenic in soils of the Helena Valley area of Montana was undertaken. The purpose of the investigation was to determine the extent of contamination of the soils by emissions from the smelter operation in East Helena. Author

N72-19386# Environmental Protection Agency, Research Triangle Park, N.C. National Environmental Research Center.
SOIL AND VEGETATION STUDY
Ibrahim J. Hindawi and Grady E. Neely *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 81-94 (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

During the summer of 1969, a study was undertaken in the Helena Valley area of Montana to determine the effects pollutants were having on area vegetation. The pollutants of interest were arsenic, cadmium, lead, zinc, and sulfur dioxide. The investigation had three purposes: (1) to determine how vegetation is being contaminated by heavy metals, (2) to determine the concentrations of heavy metals being accumulated in vegetation in the area, and (3) to assess any sulfur dioxide damage that might be occurring in the valley. Author

N72-19387# Montana Univ., Missoula. Dept. of Botany.
EFFECTS OF AIR POLLUTION ON INDIGENOUS ANIMALS AND VEGETATION c04
C. C. Gordon *In* Environ. Protection Agency Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 95-112 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

Investigations were undertaken to document the association between concentrations of lead and cadmium in indigenous vegetation and in animals ingesting such vegetation and to determine whether the accumulation of lead and cadmium in the vegetation surrounding the East Helena smelters results from absorption of the metals through the roots from the soil or through the leaf surfaces from the atmosphere. The effects of sulfur dioxide on plants in the study area were also assessed. The extent of accumulation of lead and cadmium in indigenous animals and in the grasses upon which they feed was determined and a quantitative study of the lead and cadmium content of garden vegetables was conducted. A third study involved transfer of East Helena soil from several sites to Missoula, where vegetables (primarily lettuce) were grown and then assayed for lead and cadmium. A fourth study involved the feeding of rabbits with lettuce grown in several locations to determine the amount of accumulation of lead and cadmium in rabbit tissues as related to the food source. Indigenous conifer vegetation was examined for damage produced by air pollution. Author

N72-19388# Environmental Protection Agency, Research Triangle Park, N.C. National Environmental Research Center.
EFFECTS OF AIR POLLUTION ON LIVESTOCK AND ANIMAL PRODUCTS c04
Trent R. Lewis *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 113-124 (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

The effects of air pollution on livestock and consumable products derived from livestock were assessed. Two questions were of significance: (1) what was the primary effect of air pollution on the health of the livestock per se and (2) what was the health hazard to humans who ingested meat, milk, and eggs from such farm animals? Author

N72-19389# Environmental Protection Agency, Research Triangle Park, N.C. National Environmental Research Center.
TRACE-METAL CONCENTRATIONS IN HUMAN HAIR c04
D. I. Hammer, J. F. Finklea, R. H. Hendricks, C. M. Shy, and R. J. N. Norton *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 125-134 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

Human scalp hair was collected to determine whether the content of three trace metals, lead, cadmium, and arsenic, reflected environmental concentrations in East Helena, Helena, and Bozeman, Montana. These cities represented an exposure gradient for Pb, Cd, and As as follows: East Helena > Helena > Bozeman. The explicit hypothesis to be tested was that mean hair concentrations of Pb, Cd, and As would reflect this exposure gradient and would differ significantly between cities at the

$p<90.05$ level when tested by a one-way analysis of variance. Logarithmic transformations of trace metal data, often appropriate, were used in this study. Author

N72-19390# Food and Drug Administration, Washington, D.C.
POSSIBLE HAZARDS ASSOCIATED WITH INGESTION OF GARDEN VEGETABLES CONTAMINATED BY TRACE METALS **c04**
Samuel I. Shibko *In* Environ. Protection Agency Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 135-144 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

Contamination of garden vegetables in the Helena Valley, Montana, area need to be studied in order to assess the adverse effects that could be associated with the inclusion in the human diet of vegetables grown in the valley. Concentrations of the specified trace metals in the vegetables and the daily consumption of these vegetables must first be determined. In addition, the acceptable daily intake of arsenic, cadmium, lead, and zinc must be estimated. The estimates of acceptable dietary intake given were derived from data on the trace metal content of foodstuffs, air, and water, and from data on the rates and routes of excretion of trace metals. Author

N72-19391# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
POLLUTION SOURCES
Francis M. Alpiser, Marius J. Gedgaudas, and Harold B. Coughlin *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 145-160 (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

An emission inventory covering sulfur oxides, particulate matter, nitrogen oxides, hydrocarbons, and carbon monoxide was made for the Helena Valley area in 1968. Although industrial processes are the primary source of emissions in the valley, fuel combustion in stationary sources, transportation, and open burning also contribute to the overall problem. The primary pollutant is sulfur dioxide. The particulate emission data are lower than the actual amount, because dust from unpaved roads is a major problem in the area. The pollutants are summarized in percent for the four source categories. The East Helena industrial complex is described, including the lead smelter of American Smelting and Refining Company, the slag-processing activities of the Anaconda Company, and the paint pigment production of the American Chemet Corporation. The operations of the three contributors to pollution are listed, and the sulfur oxide and particulate emissions are given for each one. Author

N72-19392# Environmental Protection Agency, Research Triangle Park, N.C. National Environmental Research Center.
METEOROLOGY AND SOURCE-RECEPTOR RELATIONSHIPS **c20**
Paul Humphrey *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 161-179 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

Air movement, atmospheric stability, and temperature inversions in the Helena, Montana area are discussed. Their effects on potential air pollution episode days and diffusion estimates of mean short and long term SO2 concentrations are considered. Dispersion of particulate material was also investigated. The climatology of the Helena Valley was compared with observed conditions during the study period (June through October 1969) so that the representativeness of the study period could be estimated. It was concluded that measured air pollution concentrations are somewhat below those expected because of the above normal amount of rain and associated windy conditions in June, July, and October. K.P.D.

N72-19393# Environmental Data Service, Silver Spring, Md. Office of the Associate Administrator for Science and Technology.
BOMEX TEMPORARY ARCHIVE: DESCRIPTION OF AVAILABLE DATA
Terry DeLamoriniere Jan. 1972 318 p
(NOAA-TR-EDS-10) Avail: SOD $2.25

The data available from the BOMEX Temporary Archive, a depository for data collected during May, June, and July 1969 are described. Procedures used in processing these data, inventories of the archived data, and ordering instructions and costs are given. Author

N72-19394# Advisory Group for Aerospace Research and Development, Paris (France).
PROPAGATION LIMITATIONS IN REMOTE SENSING
John B. Lomay, ed. (Stanford Res. Inst., Menlo Park, Calif.) Oct. 1971 432 p refs In ENGLISH and partly in FRENCH Presented at 17th Symp. of the Electromagnetic Wave Propagation Panel of AGARD Colorado Springs, 21-25 Jun. 1971 Original contains color illustrations
(AGARD-CP-90-71) Avail: NTIS HC $6.00/MF $0.95

Feasible techniques in detection and control of pollution problems are discussed. Conference papers on theoretical and experimental aspects of remote sensing systems and their applications are presented. These papers included: multisensors and systems in remote sensing, radar sensing systems over land, remote sensing techniques in oceanography, interference of propagation media and background, infrared techniques in remote sensing, photography in remote sensing, and analytical studies in remote sensing. For individual titles, see N72-19395 through N72-19426.

N72-19395# Army Engineer Topographic Labs., Fort Belvoir, Va.
PROJECT SAND: REMOTE SENSING FOR ENGINEER CONSTRUCTION MATERIALS
Donald G. Orr and James R. Quick *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 17 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

Remote sensor flights were conducted over areas in the Mississippi Delta to determine the sensor configuration, analysis techniques, and diagnostic criteria for locating engineer construction materials under Project Sand. The sensor utilized included photography (color, color infrared and panchromatic), thermal infrared and sidelooking radar (brute force and coherent). In addition to the aerial imagery acquisition, ground measurements were made in each of the areas under investigation. The sensor imagery and ground truth data were analyzed. The airborne operations and field data collection are described. Author

N72-19396# Development and Resources Transportation Co., Silver Spring, Md.
ATOMATIC PROCESSING OF ARCTIC PACK ICE DATA OBTAINED BY MEANS OF SUBMARINE SONAR AND OTHER REMOTE SENSING TECHNIQUES
Leonard A. Leschack, William D. Hibler, III (Army Cold Reg. Res. and Eng. Lab., Hanover, N. H.), and Frederick H. Morse (Maryland Univ., College Park) *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs (See N72-19394 10-13)
(Contract N00014-70-C-0110)
Avail: NTIS HC $6.00/MF $0.95

Three remote sensors were used for examining the upper and under surface of the arctic ice pack: an upward looking sonar mounted on a nuclear submarine transiting beneath the ice, producing an under ice profile; a vertically mounted airborne laser, producing an upper ice surface profile; and an airborne infrared scanner in the 8-14 microns range, producing a heat picture of the ice surface. The sonar data were digitized, and power spectrum and frequency distribution of amplitude analyses were conducted. Power spectrum analysis indicated preferred spacing of pressure ridges with apparent periods of 20-25,

35-40, and 80-100 m. Comparison of the power spectra of two profiles intersecting at a right angle showed the expected spatial period shift of significant ice ridge ensembles and so suggests a potential real-time technique for determining, from submarines cruising submerged, ice ridge orientation. This enhances the probability of finding open water. Frequency distribution of amplitudes of the profile data indicates that young ice has a sharp, unimodal distribution, older, more jumbled ice has a broad-based unimodal distribution and old, much ridged ice has a bimodal distribution. The same analytical techniques were used to process airborne laser profile data of pack ice. Analysis of profiles of multi-year ice and young ice show that the young ice has greater amplitude of all ridge spacings shorter than 20 m than does the multi-year ice. Author

N72-19397# Communications Research Centre, Ottawa (Ontario).
THEORY AND FIELD TESTS OF A MICROWAVE RADIOMETER FOR DETERMINING SEA ICE THICKNESS
A. W. Adey *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

A theoretical analysis of the UHF emissions from sea ice and/or sea water is outlined. This work indicates that a radiometer system designed to observe these emissions could be used to determine the thickness of sea ice. To explore this possibility, a radiometer operating at frequencies from 400 MHz to 1.5 GHz was designed and built. The results of initial ground based and airborne tests of this instrument are presented. These initial results tend to confirm the theoretical analysis and predictions. Author

N72-19398# Kansas Univ., Lawrence. Remote Sensing Lab.
RADAR IMAGING APPLICATIONS: PAST, PRESENT AND FUTURE **c07**
Richard K. Moore *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

Some of the proven applications of radar are outlined, and future applications that are not yet proven are suggested. Although restricted mostly to imaging systems, brief mention is made of the application of nonimaging radars to determining wind speeds over the oceans. Author

N72-19399# Louisiana State Univ., Baton Rouge. Dept. of Geography and Anthropology.
CUMULATIVE FREQUENCY CURVES OF THE DARIEN PROVINCE, PANAMA
Anthony J. Lewis (Arkansas Univ.) and William Waite *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

A method for obtaining terrain slope information from radar imagery was developed utilizing (1) the necessary relationship between terrain slope and the depression angle for the occurrence of radar shadows and (2) the variation in depression angle from near to far range across the radar image. Six different geographic regions were selected in the United States, where both topographic coverage and radar imagery were available. The results were encouraging especially in rugged mountainous terrain where topographic coverage is generally the least accurate. The method was applied to two strips of radar imagery of the Darien Province, Panama. Each strip of imagery was approximately 1,000 square miles in area and oriented transverse to the structural grain of the landform regions. A cumulative frequency slope curve was determined for each geomorphic region qualitatively delineated on the radar imagery of the Darien Province. Author

N72-19400# Kansas Univ., Lawrence. Dept. of Geography.
VEGETATION MAPPING WITH SIDE-LOOKING AIRBORNE RADAR: YELLOWSTONE NATIONAL PARK
Normal E. Hardy, Jerry C. Coiner, and William O. Lockman *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The delimiting of vegetation communities of Yellowstone National Park is studied by interpreting SLAR imagery and identifying factors for future projects. The boundaries of the vegetation communities are defined; a classification of vegetation types was established based on elevations, moisture, and slope features. The imagery results were compared with ground truth maps. Author

N72-19401# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE RADAR BACKSCATTER OF VEGETATION
G. P. DeLoor and A. A. Jurrieens *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

To study image tone in SLAR imagery, a series of measurements was performed at X-band (and some at K-band) on the backscatter coefficient of single fields in an agricultural area through a complete growing season. A stable platform (television tower) with the radar at an altitude of 75 m (230 ft) above the terrain was used. The weather effect on the backscatter coefficient is studied by comparing the measurements with the output of an automatic weather station. Author

N72-19402# Naval Research Lab., Washington, D.C. E. O. Hulbert Center for Space Research.
WAVE HEIGHT MEASUREMENTS WITH A NANOSECOND RADAR **c07**
B. S. Yaplee, A. Shapiro, D. L. Hammond, and E. A. Uliana *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p ref (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

A radar system was developed with a narrow pulse width to resolve the vertical wave structure of ocean waves. The radar illuminated a 70 cm diameter spot on the ocean at normal incidence, and three wave poles were placed in a delta configuration around the spot for ground truth measurements. A corner reflector was placed at the center of the antenna beam to calibrate the radar measurements both in range and amplitude. Wind conditions were monitored using the tower's anemometer. These ground truths were then used in relating the radar measurements to the actual sea conditions. The wave heights encountered ranged from two to six feet. The results of the radar measurements are presented and compared with the simultaneous wave pole measurements of the sea surface structure. Author

N72-19403# Naval Research Lab., Washington, D.C. E. O. Hulbert Center for Space Research.
REMOTE PASSING MICROWAVE MEASUREMENTS OF THE SEA SURFACE
James P. Hollinger *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See N72-19394 10-13)
(Order WR1-0075)
Avail: NTIS HC $6.00/MF $0.95

The potential of all-weather determination of ocean surface wind fields by means of remote passive microwave sensing is discussed. The wind speed dependence of the microwave brightness temperature of the sea is interpreted as resulting primarily from small scale wave structure at wind speeds below about 15 to 20 m/sec and from the increasing coverage of sea foam at higher wind speeds. Measurements of these two effects are presented and the characteristics of each described separately. The two effects are combined to estimate the total microwave brightness temperature dependence of a wind driven sea as viewed from a satellite. Taken together the two effects allow the determination of ocean surface wind fields over the entire range of wind speeds. The sensitivity to wind speed increases with observational frequency and is most pronounced for horizontal polarization at larger incidence angles. Author

N72-19404# Naval Research Lab., Washington, D.C.
REMOTE SENSING OF OCEAN EFFECTS WITH RADAR
N. W. Guinard *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 12 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The four-frequency radar (4FR) system, a calibrated airborne measurement facility, was extensively used for data collection. The 4FR system is a laboratory radar capable of operating sequentially on X band (8910 MHz), C band (4455 MHz), L band (1228 MHz), and P band/UHF (428 MHz) with both horizontal and vertical polarization. The radar was used to acquire sea return data from a variety of sites where independent surface truth was available. The theoretical models and the parametric relationships, which were found and which offer promise in the design of sensors are presented. Two techniques for remotely sensing wave spectra were evolved and used to obtain an explanation for the wavelength dependence of the sea return in low wind fields. Synthetic aperture radar also was used in ocean applications. Oil spills, both accidental and programmed, were imaged and the absence of radar return from the oil covered surfaces related to the damping of the capillary and short gravity waves by the surface film. Author

N72-19405# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany). Dept. of Telecommunications.
PROPAGATION EFFECTS ON MONITORING ATMOSPHERIC FINE STRUCTURE USING SIDE-SCATTER ON APPROPRIATE FREQUENCIES
H. J. Albrecht and M. Piening *In* AGARD Propagation Limitations in Remote Sensing Oct. 1972 7 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The possibilities of extending side-scatter analysis to high frequencies are discussed. With regard to monitoring air pollution above industrial areas, cities, and other exposed areas, the limits of detecting appropriate element sizes are examined, as well as the combination of such methods with turbulence analysis by side-scatter for estimating the degree of danger and its variation. Author

N72-19406# Fengler (C.), Hamburg (West Germany).
REMOTE SENSING AND ATMOSPHERIC LAYERS
C. Fengler *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 8 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

Reflection as well as ducting effected by atmospheric layers are considered. As example for an ionospheric and a tropospheric layer, the reflection coefficient of Epstein profiles is treated to illustrate the total reflection effect by grazing incidence. The deflection from a concentric layer of rays starting at the earth's surface and of rays coming from the outside of the earth is considered. The theoretical treatment is completed by presenting measurements of an earth - earth radio link, as well as of a space - earth radio link evaluated under the aspect of the tropospheric layer structure. Author

N72-19407# Wisconsin Univ., Middleton. Geophysical and Polar Research Center.
ELECTROMAGNETIC SOUNDING OF ICE THICKNESS
C. R. Bentlye and J. W. Clough *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The efficiency of ice thickness determination in Antarctica and elsewhere was improved by electromagnetic sounding. The electromagnetic sounder, which is basically a low-frequency radar system, is adapted to an aircraft, and is capable of measuring thicknesses of ice as great as 4 km. The attenuation in very cold ice is so small that it is substantially less than the normal spherical-spreading loss. Losses occurring at the reflecting boundary are about 10-20 db for most earth materials, but may be more if the boundary is rough. At a sharp ice-sea water boundary, however, the reflection loss is only 0.5 db, a fact which makes electromagnetic sounding particularly effective over floating ice shelves. It is possible to distinguish the boundary between floating and grounded ice on the basis of reflection strength. Additional losses may result from scattering or reflection from bubbles, crystals, or density discontinuities within the ice. Because of the purity of antarctic glacier ice, and the relatively long wave lengths employed, such losses should be small, even though many internal reflections are observed within the top one or two kilometers of the ice sheet. Author

N72-19408# Army Engineer Topographic Labs., Fort Belvoir, Va.
A MATHEMATICAL ANALYSIS OF THE PROPAGATION AND REFLECTION OF PLANE ELECTROMAGNETIC WAVES IN A NONHOMOGENEOUS ISOTROPIC MEDIUM c07
Richard A. Hevenor *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

A nonhomogeneous half space where the conductivity and dielectric constant are arbitrary functions of depth is analyzed. The basic approach employed is that of the geometrical optics solution of the wave equation. The final results yield expressions for the magnitude and phase of an electromagnetic field propagating in the nonhomogeneous medium for horizontal and vertical polarizations. Author

N72-19409# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif. Propagation Technology Div.
REMOTE SENSING OF TROPOSPHERIC STRUCTURES USING HIGH RESOLUTION RADAR
J. H. Richter, E. E. Gossard, and D. R. Jensen *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

A very sensitive, ultrahigh resolution radar was developed for studying the refractive index structure of the troposphere. The radar is a ground based, vertically pointing FM-CW-radar (frequency modulated, continuous wave) with a range resolution of one meter. The radar and its performance characteristics are described. The radar routinely detects layer structures in the lower troposphere. These layers are always associated with gradients in the vertical refractive index profile, and are frequently very thin, approaching the resolution of the radar often they are perturbed by wave motion. Examples of various wave patterns are presented. Author

N72-19410# Wisconsin Univ., Middleton. Geophysical and Polar Research Center.
EFFECT OF BEAM WIDTH ON ACOUSTIC SIGNALS SCATTERED AT A ROUGH SURFACE c23
C. S. Clay and G. A. Sandness *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 8 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

Analysis of the data is varied; sometimes the interaction at the bottom is treated as a reflection, and sometimes as a scattering process. Underwater acoustic experiments were made in a laboratory tank in which the signals were scattered at a wind-blown surface. The rms roughness and spatial correlation function of the surface were measured by wave height probes. The ratio of the mean rectified signal scattered at the rough surface and that reflected at the smooth surface was measured for vertical incidence. Even though the surface was rough, the mean rectified signal was inversely proportional to the source distance plus receiver distance. At large roughness, the reflection-scattering function (bottom loss) depends upon beam width and tends to the usual plane interface reflection function at small values. Author

N72-19411*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
INFRARED AND MULTISPECTRAL REMOTE SENSING
M. R. Holter *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs Original contains color illustrations (See N72-19394 10-13)
(NASA-TM-X-67558) Avail: NTIS CSCL 03B

The history of infrared analysis from the discovery in 1800 of infrared radiation by Herschel is sketched. Recent advancements are described leading to modern infrared remote sensing devices. The performance of such devices is illustrated and future directions of development outlined. The recent extension of the infrared scanner to the multispectral sensing and pattern recognition system is described. Results from such systems are shown, limitations in their utility due to lack of understanding of signatures described, and the likely future course of development is outlined. Author

N72-19412# Laboratoire d'Electronique et de Physique Appliquees, Paris (France).
FUNDAMENTAL AND PRACTICAL LIMITS OF REMOTE INFRARED IMAGING INSTRUMENTS OPERATING BETWEEN 2, 5 AND 18 MICRONS **c14**
F. Desvignes *In* AGARD Propagation Limitations in Remote Sensing refs In FRENCH; ENGLISH summary (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The main interest of infrared radiation is discussed in relation to remote sensing, and the relations between space, time, and signal level resolving power of the instruments. The effect of the propagation (signal attenuation and stray radiation is considered). An analysis of results of a computation of the overall atmosphere transmittance are presented for various types of detectors (photon and energy detectors). This computation takes into account the absorption and diffusion by gases and aerosols in horizontal propagation as a function of distance. Author

N72-19413# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
INTERPRETATION OF TEMPERATURE MEASUREMENTS OF THE SEA BY INFRARED RADIOMETRY [INTERPRETATION DES MESURES DE TEMPERATURE DE LA MER PAR RADIOMETRIE INFRAROUGE]
P. Y. Deschamps, P. Lecompte, and J. C. Vanhoutte *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs In FRENCH (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The corrections were studied which are necessary for radiometric measurements of temperature of the sea surface in order to obtain the actual temperature. The major cause of measurement error is sky reflection on the sea surface. This was studied on the basis of measurements made at sea level. The second source of error is air level transmission between sea and radiometer; this was evaluated theoretically. These corrections should lead to absolute temperature determinations of the surface, based on aerial measurements, with a precision on the order of 0.1 degree. Transl. by K.P.D.

N72-19414# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
INTERPRETATION OF TEMPERATURE MEASUREMENTS AND STRUCTURE OF CLOUDS BY INFRARED RADIOMETRY [INTERPRETATION DES MESURES DE TEMPERATURE ET STRUCTURE DES NUAGES PAR RADIOMETRIE INFRAROUGE]
Y. Fouquart and J. Lenoble *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 8 p refs In FRENCH (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The angular distribution of solar radiation intensity was investigated in the atmosphere in the carbon dioxide absorption band at 4.3 microns, for the case of a cloudy atmsophere. Two cloud densities were assumed and the study was made for 12 frequencies. It was shown that the radiation intensity observed strongly depends on the optical depth of the cloud. Transl. by K.P.D.

N72-19415# National Environmental Satellite Center, Washington, D.C.
FACTORS AFFECTING THE ACCURACY OF SEA-SURFACE TEMPERATURE MEASUREMENTS FROM ITOS-SR DATA
J. Leese, W. Pichel, B. Goddard, and R. Brower *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The Improved Tiros Operational Satellite (ITOS) sensor package contains a two-channel scanning radiometer (SR) which operates in the 0.52- to 0.73-micron visible range and the 10.5- to 12.5-micron infrared (IR) water vapor window. One of the primary applications of the IR data is determination of global sea surface temperatures. The objective is to make statistically integrated measurements, over areas approximately 100 km on a side, which agree with ground truth measurements within a root mean square deviation no larger than 1 C. A quantitative error analysis of the ITOS system, combined with tests on real data, showed that the objective should be reached using only IR data in regions where the magnitude of the temperature gradient is less than 2 C per 100 km. In regions where the temperature gradients are 2 to 4 C per 100 km, the inclusion of SR data from the visible channel to reduce cloud contamination errors should place the accuracy objective within accessible limits. Author

N72-19416# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ERBIUM LASER PROPAGATION IN A CO2 ATMOSPHERE IN THE NEAR INFRARED **c16**
Kenneth O. White, E. Howard Holt, Stuart A. Schuleusener (New Mexico State Univ., Las Cruces), and Robert F. Calfee (NOAA, Boulder, Colo.) *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 5 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The transmission of the laser energy in a carbon dioxide atmsophere was measured in the 1.54 micron spectral region. An erbium laser was used which had two output emission regions in the eye-safe realm of the spectrum, one region centered at 1.536 micron and 1.0 nm wide, and the other centered at 1.543 micron and 2.0 nm wide. The CO2 sample was contained in a pressure- and temperature-controlled, 20 m White cell. The monitor and transmitted laser pulses were detected by germanium photodiodes and recorded on a dual parameter pulse height analyzer which provided a real time indication of the transmission and the quality of the data. A spectral scan over the laser output was obtained by sending a portion of the laser beam through a 3.3 m grating spectrometer which was preset to a narrow (about 0.01 nm) spectral region within one of the two output regions of the laser. A signal from the spectrometer was used to trigger the analyzer to accept only those laser spikes with wavelengths which fall within the preset wavelength window of the spectrometer. The spectrometer was scanned over the laser output and the transmission obtained as a function of wavelength. Data and theoretical calculations are presented for a 480 m path length, a temperature of 30 C, and a CO2 pressure of one atmophsere (660 torr). Author

N72-19417# Kansas Univ./Center for Research, Inc., Lawrence.
EFFECT OF ANGULAR VARIATION ON TERRAIN SPECTRAL REFLECTIVITY
Dwight D. Egbert and Fawwaz T. Ulaby *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-19394 10-13)
(Contract DAAK02-68-C-0089)
Avail: NTIS HC $6.00/MF $0.95

A technique is described whereby one may pre-test in order to determine the optimum filter combinations and the feasibility

of multiband photography in the visible and infrared regions. The test provides multispectral reflectivity curves not only for the targets or categories to be identified, but also for those backgrounds against which they are usaully encountered. The procedure incorporates a method for determining spectral reflectance as a function of solar altitude, incidence look angle, and azimuth look angle. It was found that for one target-background pair (asphalt and grass), the contrast ratio may range from 2:1 to 0.5:1 under different angle conditions. Author

N72-19418# Army Engineer Topographic Labs., Fort Belvoir, Va.
THE USE OF COLOR AERIAL PHOTOGRAPHS IN THE RECONNAISSANCE OF SOILS AND ROCKS c14
Abraham Anson *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

Controlled tests were conducted in the interpretation of soil and rocks in the Eastern Coastal Plain area (near Bennettsville, South Carolina) and the western desert regions near Phoenix, Arizona. It was found that using color film, the reconnaissance of inaccessible areas and rock structures can be more rapidly carried out utilizing aerial photographs, than by ground exploration or black-and-white film. Soil conditions can by analyzed without the necessity for ground survey by using 1:20,000-scale aerial color and infrared photographs. Author

N72-19419# Kansas Univ./Center for Research, Inc., Lawrence.
AN ANALYSIS OF MULTISPECTRAL IMAGERY FOR TROPICAL LAND USE DISCRIMINATION
Roland D. Mower *In* AGARD Propagation Limitations in Remote Sensing refs (See N72-19394 10-13)
(Contract Di-14-08-0001-12077)
Avail: NTIS HC $6.00/MF $0.95

NASA mission 98 included a number of flight lines over Puerto Rico. Imagery data were analyzed to determine to what extent selected land use classes could be distinguished using conventional image interpretation techniques. The results were compared with those obtained through use of a semi-automated densitometer/computer process. The semi-automated technique was also employed to determine which of the nine imagery channels (Ektachrome blue, green, red, and IR; multiband blue, green, red, and IR; and IR scanner) provide the best discrimination for each of the land classes considered. Finally, selected channels were combined and the tests repeated. A number of tentative conclusions were made regarding the relative performance of the imagery channels tested. Author

N72-19420# TRW Systems Group, Redondo Beach, Calif.
SEA BRIGHTNESS TEMPERATURES AT MICROWAVE FREQUENCIES
R. J. Wagner and P. J. Lynch *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 16 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

A complete geometrical optic theory of rough surface emission and scattering was developed which accounts explicitly for surface shadowing effects and the contributions of double-scattered radiation. The validity of the emission theory was tested by comparing the results with a case for which the exact solution was known. A theorem is proved which establishes, for the domain of geometrical optics, the existence of rigorous upper and lower bounds to the effects of surface roughness on brightness temperatures. The Peake representation yields the upper bound, provided shadow corrections are included, while an alternative representation provides the lower bound. Microwave brightness temperatures for the sea were calculated for a cylindrical roughness model. Double scatter contributions are shown to be appreciable and, with their inclusion, accurate calculation of brightness temperatures is possible. A model for a wind-driven spray layer was integrated into the theory and semi-empirical corrections for foam were added; the results agree well with rough-sea data. Possible extensions and modifications of the theory are discussed. Author

N72-19421# Air Force Cambridge Research Labs., Bedford, Mass.
STATISTICAL METHODS OF INDIRECT PROBING OF THE ATMOSPHERE c20
V. Falcone, Jr. and K. Mano *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 5 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

Three statistical methods for inversion of the radiative transfer equation (or any Fredholm integral equation of the first type) are examined. For the microwave region of the electromagnetic spectrum, the unknown function to be determined under the integral of the radiative transfer equation is the atmospheric temperature. The temperature profile can be determined by applying linear estimation theory or by assuming a smoothing functional which is minimized by the Euler-Lagrange equation. These two methods are shown to be equivalent when appropriate identification of terms is made, and where the regularization term of the smoothing functional is a linear differential operator. Stabilization of the empirical eigenfunctions is reviewed. This technique yields limited accuracy in the determination of the temperature profile parameters from experimental a priori data. It is shown to be qualitatively related to the mean square of the Bayes theory. Author

N72-19422# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
IMAGE ANALYSIS BY MULTIPLEX CODING c07
Andre Girard *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 15 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

The case of incoherent radiation distribution, is considered. It was analyzed by means of a system whose radiation transducer was a flux detector receiving incoming signals in a coded form. The coding presents the characters of a multiplex method; it ensures the optimum use of the available time to analyze the distribution under study. The flux detector receives the radiation issued from all the elements of the space function. A gain in the signal/noise ratio may thus be obtained, compared with direct analysis methods. The spectral range considered was in the infrared region. According to the first experimental results obtained, the use of pseudo-random, binary, cyclic codes seems best in view of the practical advantages they offer. Author

N72-19423# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
AN APPLICATION OF THE MONTE CARLO METHOD TO REMOTE SENSING SYSTEMS
J. Roettger *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

Probability distributions of wave paths through a refractive medium were determined by using statistical probability distributions of the refractive index depending on time and space. Monte Carlo calculations, simulating an experiment by statistical computer mathematics, were carried out for ionospheric off-great-circle propagation on the transequatorial radio path Lindau, West Germany - Tsumeb, South West Africa. These calculations yield information about the error probability and reliability involved in determining side-reflection areas in the equatorial zone, using probability distributions of the parameters of ionospheric wave propagation. Statistical tests proved that results, computed from remotely measured data by means of a Monte Carlo technique, agree with direct measurements at the equator. Author

N72-19424# Michigan State Univ., East Lansing.
TURBULENCE AND REFRACTIVITY CHANGES AND THEIR SENSING BASED UPON THE WAVE MECHANICS THEORY c12
M. Z. V. Krzywoblocki *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-19394 10-13)

Avail: NTIS HC $6.00/MF $0.95

Some methods of the quantum field theory in statistical physics are discussed, particularly with a view of applying them to a Bose fluid type of medium. The application of the wave mechanics theory (Schroedinger's equation) is considered for a spatial domain in a turbulent field. The problem of wave propagation in a turbulent medium is presented, with a discussion of scattering of electromagnetic and acoustic waves in the turbulent atmosphere, as well as of the influence of the turbulent field upon the magnitude and the variation of the refractive index for radio waves. Application of remote sensing to the analysis of atmospheric turbulence and refractivity variations is also discussed. Author

N72-19425*# Kansas Univ./Center for Research, Inc., Lawrence.
ON BACKSCATTERING FROM TWO-SCALE ROUGH SURFACES
A. K. Fung and H. L. Chan *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p refs (See N72-19394 10-13)
(Contract NAS1-10048)
(NASA-CR-125756) Avail: NTIS CSCL 20N

Two versions of the two-scale composite rough surface model are presented. The first is the small perturbation model, in which the effect of the tilt in the plane of the picture can be accounted for by a change in the angle of incidence, by resolving the incident plane wave into horizontally and vertically polarized components, or by both. The second model is more complicated and is approached with the assumption of noncoherence, i.e., the contribution from small irregularities may be computed by summing powers from the large facets constituting large undulations. The total contribution from the composite surface is then taken to be that from the large undulations plus that from the small irregularities averaged over the large undulations. If the assumption of noncoherence is not made, the total scattered field from the illuminated area must be computed before evaluating the power. The vertically and horizontally polarized scattering coefficients were calculated. The surface was assumed to be finitely conducting and homogeneous, the surface roughness may be nonuniform. The special form of the terms due to exclusion of noncoherence, and the meaning of such terms, are discussed. Author

N72-19426# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
THE IDENTIFICATION OF INHOMOGENEOUS MEDIA FROM TRANSIENT DIFFUSION OF ELECTROMAGNETIC FIELDS c07
J. N. Towle *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs (See N72-19394 10-13)
(Grants NSF GK-231; NSF GK-21218)
Avail: NTIS HC $6.00/MF $0.95

For the purposes of magnetotelluric exploration the penetration of electromagnetic energy into the conducting strata presented by the earth's crust may be described by the parabolic equation of diffusion with a spatially dependent coefficient. A difference-differential solution to this equation was implemented on a hybrid computer and the resulting time-dependent solutions were studied. A direct search procedure was used to minimize the mean square deviation of the estimated response from the observed response through successive adjustments in the parameters of an estimated conductivity model. Computer-generated transient responses were used as experimental observations to verify the successful identification of several inhomogeneous media. Results are presented for the synthesis of conductivity profiles with varying degrees of complexity. Author

N72-19427*# Radio Corp. of America, Princeton, N.J.
INVESTIGATION OF LINE-OF-SIGHT PROPAGATION IN DENSE ATMOSPHERE, PHASE 3, PART 1 Final Report, May - Oct. 1971
D. A. DeWolf and G. S. Kaplan Nov. 1971 42 p refs
(Contract NAS2-5310)
(NASA-CR-114416; PRRL-71-CR-42-Pt-1) Avail: NTIS CSCL 04A

The investigation of microwave absorption in the 1 to 10 GHz frequency band by the Jovian atmosphere has continued, and an estimate of the strength of signal fading at these frequencies due to layers of turbulence in Jupiter's atmosphere is given. The microwave absorption due to gaseous ammonia is estimated both in terms of a power loss in dB/km, and in total power loss in dB for slant-path communication with a probe at altitudes down to pressures of several tens of atmospheres. The graphs indicate a frequency-squared scaling of the absorption, and appreciable losses at altitudes where the pressure is several atmospheres. An estimate of turbulence strength is given. This may turn out to be quite crude considering the absence of any relevant data. A planetary scaling law which appears to hold reasonably well for Earth to Venus, is extrapolated to Jupiter. No reasonable modifications of the estimate can alter the conclusion that direct-path fading is negligible for pressure regimes up to 20 atm. Author

N72-19428# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere Oberpfafenhofen.
INVESTIGATION ON THE VERTICAL DISTRIBUTION OF RADON DECAY PRODUCTS IN THE TROPOSPHERE BY AIRCRAFT MEASUREMENTS WITH APPLICATION TO THE VERTICAL EDDY DIFFUSION
D. Paffrath 9 Aug. 1971 128 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-63) Avail: NTIS

The vertical concentration profiles of radon B were determined during 12 flights by continuous measurement of the beta activity of fiber filters exposed to atmospheric air. The sampling function for disturbed filter equilibrium was derived. The degree of radioactive equilibrium between radon A and radon B was determined as a function of height by means of the measurement of the beta/alpha ratio. From the concentration profiles obtained, the eddy diffusion coefficient was calculated, and its relation to the vertical temperature gradient was investigated. An estimate was made of the rate of coalescence of aerosol particles with respect to cloud droplets, on the basis of the disturbance of equilibrium between radon and radon B in the cloud level.
Author

N72-19429# Kakioka Magnetic Observatory (Japan).
GEOMAGNETIC AND GEOELECTRIC OBSERVATIONS, 1970 (RAPID VARIATIONS)
1970 92 p
(Rept-11) Avail: NTIS

Geomagnetic and geoelectric observations taken by a magnetic observatory in Kakioka, Japan during 1970 are presented. The results of observations of geomagnetic rapid variations are discussed. Copies of records of the rapid-run induction magnetograms and rapid-run tellurigrams are reproduced. Magnetic measurements of geomagnetic storms, magnetic sudden impluses, magnetic bays, magnetic solar flares, and magnetic pulsations are presented in tabular form. Author

N72-19430*# Research Analysis Corp., McLean, Va. Science and Technology Dept.
PROGRAM MANAGEMENT MODEL STUDY
J. J. Connelly, J. E. Russell, J. R. Seline, and N. R. Sumner Feb. 1972 183 p refs
(Contract NAS5-11398)
(NASA-CR-122363; RAC-CR-50) Avail: NTIS CSCL 08G

Two models, a system performance model and a program assessment model, have been developed to assist NASA management in the evaluation of development alternatives for the Earth Observations Program. Two computer models were developed and demonstrated on the Goddard Space Flight Center Computer Facility. Procedures have been outlined to guide the user of the models through specific evaluation processes, and the preparation of inputs describing earth

observation needs and earth observation technology. These models are intended to assist NASA in increasing the effectiveness of the overall Earth Observation Program by providing a broader view of system and program development alternatives. Author

N72-19431*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN COLOR DETERMINATION THROUGH A SCATTERING ATMOSPHERE
Robert J. Curran Mar. 1972 34 p refs Submitted for publication
(NASA-TM-X-65849; X-651-72-58) Avail: NTIS CSCL 08C

Measurements made of the surface level albedo for ocean water containing various concentrations of phytoplankton indicate a strong correlation between wavelength dependent albedo ratios and phytoplankton chlorophyll concentration. To sense surface level albedo ratios from space platforms it is necessary to correct for the scattering and absorption properties of the atmosphere for the wavelengths in question. Atmospheric scattering models were constructed to calculate corrections at two wavelengths, 0.46 and 0.54 millimicrons. Assuming a natural background uncertainty in the aerosol optical depth of 0.1, it is found that the chlorophyll concentration may be determined to within one standard deviation of from 0.5 to 2.5 milligrams per cubic meter. By remotely sensing the aerosol optical depth to a greater accuracy it appears feasible to detect chlorophyll concentrations to uncertainty approaching 0.1 milligram per cubic meter. Author

N72-19432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALLMAG, GDALMG, LINTRA: COMPUTER PROGRAMS FOR GEOMAGNETIC FIELD AND FIELD-LINE CALCULATIONS
E. G. Stassinopoulos and G. D. Mead Feb. 1972 56 p refs
(NASA-TM-X-65844; X-641-72-17) Avail: NTIS CSCL 08E

A set of computer programs has been developed for the calculation of the geomagnetic field and the tracing of field lines in space. The basic subroutine, geocentric ALLMAG, contains coefficients for seven recently-published field models as built-in data statements. At execution time the user can vary the model and/or the time period by simply changing input parameters. Subroutine GDALMG is adapted for input and output in geodetic coordinates. ALLMAG and GDALMG are equivalent to Cain's FIELD and FIELDG, with the added flexibility of the choice of seven models. LINTRA traces field lines from any point in space to a specified altitude intersect in the same or opposite hemisphere, using any of the models contained in ALLMAG. Input is in either geocentric or geodetic coordinates, and output is returned in both. McIlwain's INVAR package, which calculates B and L, has been adapted to use ALLMAG. All programs are described in detail, and sample calculations are given. Author

N72-19433# Institut d'Aeronomie Spatiale de Belgique, Brussels.
THE ACTION OF NITROGEN OXIDES AND HYDROGEN COMPOUNDS ON THE PHOTOCHEMISTRY OF THE STRATOSPHERIC OZONE [PHOTOCHIMIE DE L'OZONE DANS LA STRATOSPHERE SOUS L'ACTION DES OXYDES D'AZOTE ET DES COMPOSES DE L'HYDROGENE]
M. Nicolet 1971 32 p refs In FRENCH; ENGLISH summary *Its* Aeronomica Acta No. A-89-1971 Submitted for publication
Avail: NTIS

The nature of the minor constituents which may have a controlling effect on stratospheric ozone is discussed and the results of calculation are given. It is shown that there is practically no direct action on the ozone molecules. All reactions involve atomic oxygen in photochemical equilibrium with ozone. Catalytic destruction of ozone by water vapor occurs through reactions of hydroxyl and hydroperoxyl radicals produced in the oxidation of water by excited oxygen atoms. With mixing ratios greater than 3 ppmv, water vapor represents a significant ozone-destroying agent in the upper stratosphere. The catalytic destruction by nitrogen oxides requires a concentration of NO molecules > 10 to the 9th power/cc above 25 km. Injection of water vapor and nitric oxide at stratospheric levels will have a controlling effect on the ozone concentration in the upper stratosphere if it leads to mixing ratios greater than 3 ppmv and 3 ppbv for water and nitrogen/dioxide, respectively. In the lower stratosphere (25 km) dynamic considerations must be taken into consideration. Author (ESRO)

N72-19434# Lockheed Missiles and Space Co., Palo Alto, Calif.
EARTH'S PARTICLES AND FIELDS
Billy M. McCormac, John E. Evans, A. C. Durney (ESRTC), and C. R. Chappell 1971 66 p refs Presented at the 9th ESRO Summer School, Cortina, Italy, 30 Aug. - 10 Sep. 1971
Avail: NTIS

The various topical areas discussed at the 9th ESRO Summer School are summarized. The lectures and discussions concerned theoretical and experimental research results relating to charged particles, electric fields, plasma physics, wave particle interaction, and other processes in the magnetosphere. ESRO

N72-19435# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
THE INVERSE PROBLEM IN HYDROGEOLOGY: BIBLIOGRAPHICAL STUDY AND DISCUSSION [LE PROBLEME INVERSE EN HYDROGEOLOGIE: ETUDE BIBLIOGRAPHIQUE ET MISE AU POINT]
Michael Friedlaender [1971] 43 p refs In FRENCH
(GRI/NTP/92) Avail: NTIS

The mathematical models used to describe the behavior of underground aquifers include parameters such as transmissivity and the storage coefficient. The problem of calibrating these models or the problem of the determination of aquifer parameter values giving the best correspondence between models and reality is considered. ESRO

N72-19436# Weapons Research Establishment, Adelaide (Australia).
UPPER ATMOSPHERE RESEARCH BIBLIOGRAPHY OF CONTAMINANT RELEASE EXPERIMENTS, PART 2
C. H. Low and K. H. Lloyd Oct. 1971 37 p refs
(WRE-TM-498-Pt-2) Avail: NTIS

This bibliography covers open literature relating to the upper atmosphere: atmospheric diffusion, density, turbulence, temperature, and wind, as well as electron and ion releases and explosions, WRE publications on contaminant release experiments, and chemical seeding. ESRO

N72-19437# Kiruna Geophysical Observatory (Sweden).
ON THE ORIGIN OF THE PREDAWN EFFECT IN THE F REGION
Ludwik Liszka Dec. 1971 22 p refs Sponsored by Swed. Natl. Council of Nat. Sci.
(KGO-717) Avail: NTIS

Some observations of the predawn effect (appearing as a dip in critical frequency and an increase in virtual height) on the electron content and on the critical frequency are compared with the solar zenith angle at the conjugate point, and the possible origin of the phenomenom is discussed. Lack of agreement is found at high latitudes between the time of occurrence of the predawn dip in foF2 and the conjugate sunrise. Another origin of the predawn effect is proposed: a heating mechanism associated with the switch over of the ionospheric field lines between the polar cusp and the magnetospheric tail. ESRO

N72-19438# Pittsburgh Univ., Pa.
PHOTOMETRIC STUDIES OF MODIFIED IONOSPHERIC BEHAVIOR, PART B Final Report, 27 Oct. 1969 - 30 Jun. 1971
M. A. Biondi, R. D. Hake, and D. P. Sipler Aug. 1971 29 p refs
(Contract F30602-70-C-0099)

(AD-733563; RADC-TR-71-222-Pt-B) Avail: NTIS CSCL 04/1

The report describes the method developed for detecting radio frequency heating of the electrons in the F region through attendant effects on the intensity of radiation from excited oxygen atoms in that region of the ionosphere. The changes in the F region of the ionosphere produced by r.f. energy from a powerful (1.6 Mw) ground-based transmitter at Platteville, Colorado, were detected optically by a spatial-scanning filter photometer constructed for the purpose. At low electron temperatures and small r.f. heating, the intensity of the atomic oxygen (1D to 3P) 6300A radiation is decreased (suppressed) as a result of reduced electron-ion recombination production of excited oxygen atoms in the 1D state. At higher electron temperatures and/or stronger r.f. heating, the 6300A intensity is increased (ENHANCED) as a result of electron impact excitation of ground state (3P) oxygen atoms to the excited (1D) state.

Author (GRA)

N72-19439# Naval Postgraduate School, Monterey, Calif.

BEACH CUSPS OF MONTEREY BAY, CALIFORNIA M.S. Thesis

Jun. 1971 157 p refs

(AD-733176) Avail: NTIS CSCL 08/3

A radiographic study was conducted on impregnated sand samples taken from beach cusps on Marina Beach, Monterey Bay, California, over a 7-month period from September 1970 to April 1971. The radiographs revealed much more structure than is discernable with the unaided eye in trenching or peeling. The microstructure found consisted of cross-lamination, rhythmic stratification, and distinct mineral layering. Migration of these cusps was studied by means of visual observations and time-lapse photography. Cyclic changes in the cusp profile were found to correspond with wave action and tidal influences. No simple relation between ocean action and cusp structure or development was evident. Author (GRA)

N72-19440# California Univ., Berkeley. Hydraulic Engineering Lab.

DETERMINATION OF DIRECTIONAL SPECTRA OF OCEAN WAVES FROM GAGE ARRAYS

Narayana N. Paniker Aug. 1971 332 p refs

(Contract DACW72-68-C-0016)

(AD-732497; HEL-1-18) Avail: NTIS HC $6.00/MF $0.95 CSCL 08/3

Directional spectra may be thought of as the distribution of wave energy with respect to frequency and direction. The development of a comprehensive and general procedure for determining directional spectra and its testing and application are discussed in this report. Author (GRA)

N72-19441# Weidlinger (Paul) Consultants, New York.

INVESTIGATION OF AIR INDUCED GROUND SHOCK EFFECT RESULTING FROM VARIOUS EXPLOSIVE SOURCES. REPORT 2: INFLUENCE OF CONSTITUTIVE MODELS ON GROUND MOTION PREDICTIONS

Melvin L. Baron, Ivan Nelson, and Ivan Sandler Nov. 1971 69 p refs

(Contract DACA39-69-C-0022)

(AD-733927; AEWES-CR-S-71-10) Avail: NTIS CSCL 08/13

The ground shock response in the superseismic range of a one megaton air burst on a homogeneous half-space of a soil is considered. Each of the three types of models was fitted to laboratory test data and calculations were made for each case. Generally, the results from all three models are comparable only when the stress paths in uniaxial strain are comparable for complete load-unload cycles. When this is not so, major differences occur in the lateral motions and stresses.

Author (GRA)

N72-19442# Lamont-Doherty Geological Observatory, Palisades, N.Y.

RESEARCH DIRECTED TOWARD THE USE OF LONG AND INTERMEDIATE PERIOD SEISMIC WAVES FOR THE IDENTIFICATION OF SEISMIC SOURCES Final Report, 1 Aug. 1968 - 31 Jul. 1971

Keith McCamy Sep. 1971 26 p refs

(Contract F19628-68-C-0341; ARPA Order 292; AF Proj. 8652)

(AD-734061; AFCRL-71-0504) Avail: NTIS CSCL 17/10

Seismological research at the Lamont-Doherty Geological Observatory is summarized. Advances are described in the use of long and intermediate period seismic waves for the identification of seismic sources in seismic instrumentation and in the analysis of global structures affecting seismic propagation. Author (GRA)

N72-19443# Aerospace Corp., El Segundo, Calif. Lab. Operations.

THERMALIZATION OF COLLIDING ION STREAMS BEYOND THE PLASMAPAUSE Technical Report, Oct. 1970 - May 1971

Michael Schulz and Harry C. Koons 15 Sep. 1971 27 p refs

(Contract F04701-71-C-0172)

(AD-734034; TR-0172(2260-20)-1; SAMSO-TR-71-266) Avail: NTIS CSCL 04/1

On field lines that are closed, oppositely directed plasma flows analogous to the polar wind can originate from conjugate regions of the ionosphere and encounter each other near the equatorial plane. For a background plasma of sufficiently low equatorial density, thermalization of the two streams can occur through the excitation of unstable ion waves. At higher densities thermalization occurs via Coulomb collision. These flows, together with the complementary thermalization mechanisms, constitute a rapid means of replenishing the plasmasphere (d(N sub O)/dt about 10/cc-hr) during the recovery phase of a magnetic storm. Beyond the quiet-day plasmapause location, the conditions for two-stream instability appear to be present continuously, since the counter-streaming plasmas are simultaneously convected to the magnetospheric boundary. Author (GRA)

N72-19444# ARO, Inc., Arnold Air Force Station, Tenn.

SIMULATION OF THE IONOSPHERE UTILIZING MICROWAVE ION GENERATION TECHNIQUES Final Report, Mar. - Jun. 1971

M. R. Busby and B. W. Gilley AEDC Dec. 1971 55 p refs

(Contract F40600-72-C-0003; ARO Proj. VW3126)

(AD-734256; ARO-VKF-TR-71-180; AEDC-TR-71-254) Avail: NTIS CSCL 04/1

An experimental investigation of the simulation of the environment encountered in the lower regions of the ionosphere (50 to 500 km) has been conducted at AEDC. Microwave cavities were utilized in conjunction with a converging-diverging nozzle and a cryogenically pumped vacuum chamber to produce supersonic flow fields with small ion number densities. A platinum, cylindrical, electrostatic probe was used to measure the voltage-current characteristics of the low density plasma in the nozzle exit plane. For exit plane Mach numbers of 2.86 to 3.17, ion densities of 575,000/cc to 1,690,000/cc and electron temperatures of 3000K plus or minus 900K were calculated using the electrostatic probe characteristics. Author (GRA)

N72-19445# Washington Univ., Seattle. Dept. of Civil Engineering.

A STUDY OF THE ACCURACY OF VISUAL PLANIMETRIC POINTINGS TO PHOTOGRAPHIC EDGES WITH DIFFERENT CHARACTERISTICS Final Report, 28 Jun. 1969 - 15 Sep. 1971

J. E. Colcord, Kenneth Lund, and Musthaq Hussain Sep. 1971 173 p refs

(Contract DAAK02-68-C-0277)

(AD-734328; ETL-CR-71-19) Avail: NTIS CSCL 08/2

The basic variations and parameters tested and discussed concern Mean Pointing Values in Relation to the Physical Edge, Precision of Pointing with various Edges, and Mach Band Measurements. Most observers show greater consistency with a sharp edge target of high contrast. While the position obtained in a tangent pointing task varies with observer by almost 30

seconds of arc, most tend to a systematic bias with pointing to the bright field most common. Further observer variation is apparently psycho-physiologically dependent and varies significantly with time. The influence of color is rather insignificant as again individual observers had large differences, however, a slightly better correlation and more pleasant working conditions were felt to occur in the yellow-green region of the spectrum.
Author (GRA)

N72-19446# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
COMPARISON OF LINEAR TRENDS IN TIME SERIES DATA USING REGRESSION ANALYSIS
Elton P. Avara and Bruce T. Miers Fort Monmouth, N. J. ECOM Aug. 1971 44 p refs
(DA Proj. 1T0-61102-B-53-A)
(AD-734331; ECOM-5403) Avail: NTIS CSCL 12/1

Under the assumption that each of two sets of time series data contains a linear trend and stationary Gaussian autocorrelated noise, equations are developed to test the null hypothesis that the trends are the same. Due to the frequency of occurrence of red noise (the noise elements form a linear first-order Markov chain) in geophysical data, this type of noise is treated in detail. The consequences of assuming the wrong red noise model for the data are investigated. The techniques developed in the paper are then applied to atmospheric density data derived from rocket measurements, and the effects of different red noise models are shown. As a result the density noise is found to be red noise with a lag one-kilometer autocorrelation coefficient of about 0.8 and a standard deviation of approximately 1.085% of the true density.
Author (GRA)

N72-19447# Illinois Univ., Urbana. Dept. of Civil Engineering.
TELEVISION DISPLAY OF TOPOGRAPHIC INFORMATION Final Report, Sep. 1970 - Nov. 1971
Kam W. Wong and Nick G. Yacoumelos Nov. 1971 66 p refs
(Contract DAAK02-71-C-0045; DA Proj. 4A0-61102-B-52-C)
(AD-734367; UILU-ENG-71-2025) Avail: NTIS CSCL 08/2

The objective of this Phase was to investigate the resolution capability of color TV in identifying details from line-maps and picto-maps, and to establish the relative merits of color and black-and-white TV systems.
Author (GRA)

N72-19448# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.
A METHOD FOR RAPID COMPUTATION OF VLF, STEEP-INCIDENCE REFLECTIONS FROM THE IONOSPHERIC D-REGION Research and Development Report, Oct. 1970 - Jun. 1971
J. R. Hill 19 Aug. 1971 26 p refs
(ZR0110101)
(AD-734392; NELC-TR-1784) Avail: NTIS CSCL 04/1

A method for the rapid computation of coefficients for VLF reflections from the ionospheric D-region is described. Previously calculated wave-field solutions are used to compute reflection coefficients for new electron-density profiles. The usefulness of the method is demonstrated by a study of several D-region profiles. The study shows the sensitivity of the reflection coefficients to small changes in the profiles. Experience indicates that three to six times as many profiles can be examined in a parametric study than was previously possible for a given computer cost. The resulting increase in computational speed greatly facilitates parametric studies of electron-density profiles.
Author (GRA)

N72-19449# Rosenstiel School of Marine and Atmospheric Sciences, Coral Gables, Fla.
MICROWAVE RADIOMETRY OF THE OCEAN Final Report
Claes Rooth and G. F. Williams, Jr. Jun. 1971 72 p refs
(Contract N62306-69-C-0301)
(AD-734076) Avail: NTIS CSCL 08/10

The work done under this contract has established a firmer foundation for the microwave part of the hypothesis proposed by Williams (1969). The authors determined the emissivities of foam samples at .3 cm, and confirmed from photographic analysis that there is some correlation between wind speed and foam coverage on the ocean. It is possible, and in fact likely, that there exists a family of such relationships, depending primarily on sea temperature, air temperature, and the degree of development of the sea. Quarterly progress reports for the period August, 1968 to February, 1971 are included.
GRA

N72-19450# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
THE USE OF COMPLEX DIELECTRIC CONSTANT AS A DIAGNOSTIC TOOL FOR THE REMOTE SENSING OF TERRESTRIAL MATERIALS
R. S. Vickers and G. C. Rose Aug. 1971 48 p refs
(Contract F19628-70-C-0035; AF Proj. 7260; Proj. Themis)
(AD-733322; AFCRL-71-0428; SR-5) Avail: NTIS CSCL 08/7

A basic problem in remote sensing is to find parameters which can be measured that can lead to a unique signature of given target materials. Two such parameters are the dielectric coefficient and conductivity of the material. In this report the feasibility of measuring the complex dielectric constant of a smooth material from an aircraft or satellite by measuring the reflection of an incident electromagnetic wave is investigated. The results of several experimental approaches to the remote measurement of complex dielectric constant are reported. The methods investigated include X band swept frequency reflectance measurements, dual polarization, and short pulse measurements. For measurements at frequencies above 100 MHz it is shown that the dielectric constant can be determined with plus or minus 10% by measurement of the real part of the complex reflection coefficientto plus or minus 0.3 db. It is further shown that the complex polarization method for determining the complex dielectric constant is not usable for angles of incidence near the normal.
Author (GRA)

N72-19451# Ohio State Univ., Columbus. Dept. of Geodetic Science.
AN ANALYSIS OF VARIATIONAL EQUATIONS FOR THE DIRECT EVALUATION OF THE EARTHS GRAVITY FIELD
Willard D. Haverland Jul. 1971 107 p refs
(Contract F19628-69-C-0127; AF Proj. 7600)
(AD-733423; DGS-161; AFCRL-71-0421; SR-16) Avail: NTIS CSCL 08/5

The variational equations, proposed by Obenson and proposed by Rapp, which are used to generate observation equation coefficients in the direct combination of satellite and gravimetric data are critically reviewed. Each procedure is tested with respect to accuracy as a function of step size, integration procedure, and orbit time. The two procedures are combined into a single program that combines the best features of the original proposals. The study concludes that if an orbit arc of less than 15 hours is being considered, Rapp's method with a fixed fourth-order predictor and a fifth-order corrector gives the best results. If orbit arcs greater than 15 hours are being used, the combined solution composed of a fixed fourth order predictor and fifth-order corrector for anomaly integration and Obenson's method for element integration gives the best results.
Author (GRA)

N72-19452# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
DEPARTMENT OF ATMOSPHERIC SCIENCES ANNUAL REPORT, 31 OCTOBER 1970 - 31 OCTOBER 1971
Norbert Untersteiner 1 Dec. 1971 38 p refs
(Contract N00014-67-A-0103-0007; NR Proj. 307-252)
(AD-734175; AR-3) Avail: NTIS CSCL 08/12

The report summarizes research performed during the year 1 October 1970 - 30 September 1971. Research topics include: sea ice dynamics, heat and mass budget of arctic sea ice, atmospheric turbulence in the arctic, thermal and mechanical stresses in sea ice, radiation in ice, and bearing capacity of floating ice sheets.
Author (GRA)

N72-19453# Hamilton Standard, Windsor Locks, Conn.
THE RADC CARTOGRAPHIC TEST STANDARD Final Technical Report, Aug. 1970 - Jul. 1971
J. R. Byrd, H. R. Lee, D. L. Sharp, and R. I. Skolnick Griffiss AFB, N. Y. RADC Nov. 1971 177 p
(Contract F30602-70-C-0259)
(AD-734073; HSER-5883; RADC-TR-71-196) Avail: NTIS CSCL 08/2

A Cartographic Test Standard (CTS) has been designed and fabricated for utilization in the RADC Experimental Cartographic Facility (ECF). The CTS exists in two forms: digital and graphical. The digital version is the original master standard; from it the graphical standard was produced directly on a glass substrate using an extremely high accuracy of digital plotter, photoresist imaging, and etch-and-fill image fixing techniques. The CTS design was based on an analysis of both current and anticipated ECF hardware and software capabilities, chart finishing requirements of the Aeronautical Chart and Information Center (ACIC), available technologies capable of test standard fabrication, and a variety of digital and graphical techniques for error determination. The function of the CTS is to test the resolution, repeatability, and accuracy of the complement of digital/graphic equipments employed within the ECF.
Author (GRA)

N72-19454# Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
THE DISCRIMINATION OF TROPICAL LAND USE IN PUERTO RICO: AN ANALYSIS USING MULTISPECTRAL IMAGERY
Roland D. Mower Oct. 1971 240 p refs
(Contracts DAAK02-68-C-0089; DI-14-18-0001-12077; DA Proj. 4A0-61102-B-81-E)
(AD-733472; CRINC-TR-133-25; ETL-CR-71-20) Avail: NTIS CSCL 13/2

During the past decade, the technique of remote sensing has received considerable attention within the scientific community and outside of it as well. Many practical applications of remote sensing have been developed, and a great deal of research is now in progress. It seems appropriate that geographers should be actively engaged in the development and refinement of remote sensing techniques - techniques that must be designed by geographers if they are to be utilized as tools for geographic research. At the present time, remote sensing does not represent a new information system, complete with hardware, software and know-how, capable of providing all of the data that geographers previously listed under the heading 'POTENTIAL USES OF REMOTE SENSING IN GEOGRAPHY.' Although remote sensing has not yet reached the level of capability predicted for it by early enthusiasts, it has shown considerable promise. This study is just one of many that was conceived and designed to bridge the gap between abstract theoretical concepts on one hand and user oriented products on the other.
Author (GRA)

N72-19455# Engineer Agency for Resources Inventories, Washington, D.C.
NATIONAL RESOURCES SURVEY GUIDANCE MANUAL. RESOURCES ATLAS PROJECT: THAILAND
Ernest Jackman Nov. 1971 242 p refs
(DACA71-69-C-0014; ARPA Order 1035)
(AD-734007) Avail: NTIS CSCL 08/6

The basic purpose of this guidance manual is to make available the practical and technical experience accumulated during many years of work in the preparation of resources inventory studies. Included in this manual are an introductory chapter; a chapter on planning of resources inventory studies; a chapter on maps, aerial photography and cartographic techniques; a chapter on text preparation; and a chapter on data storage and retrieval. Appendixes include organizational charts of the Applied Scientific Research Corporation of Thailand and Resources Inventory Group, job descriptions for RIG, descriptions and details for 32 inventory topics, map coverage indexes for Thailand, and an example of a flow chart. Author (GRA)

N72-19456# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ELECTROMAGNETIC ION-CYCLOTRON INSTABILITIES IN MULTICOMPONENT MAGNETOSPHERIC PLASMAS Research Report, Mar. - Jul. 1971
John M. Cornwall and Michael Schulz 1 Dec. 1971 24 p refs
(Contract F04701-71-C-0172)
(AD-734530; TR-0172(2260-20)-10; SAMSO-TR-71-290) Avail: NTIS CSCL 04/1

Growth rates for ion electromagnetic cyclotron (EMC) modes are calculated for several unconventional cases of magnetospheric importance, including total absence of cold plasma and presence of artificially injected heavy-ion plasma. Artificial injection of a very heavy ion such as barium or cesium is likely to suppress, rather than enhance, instability in the important ion-EMC mode, while injection of a light ion like lithium should be very effective in promoting instability in the ring current outside the plasmapause. Author (GRA)

N72-19457# Aerospace Corp., El Segundo, Calif. Lab. Operations.
TRAVELING WAVES OF ARBITRARY AMPLITUDE IN COMPRESSIBLE HYDRODYNAMICS UNDER GRAVITY: AN EXACT SOLUTION Research Report, Mar. - Nov. 1970
Yam T. Chiu 1 Dec. 1971 33 p refs
(F04701-71-C-0172)
(AD-734531; TR-0172(2260-10)-3; SAMSO-TR-71-291) Avail: NTIS CSCL 04/1

Exact traveling-wave solutions to the hydrodynamic equations for an isothermal atmosphere stratified by a uniform gravitational field are obtained in two Cartesian spatial coordinates and one temporal coordinate and represent simple Riemannian waves of arbitrary amplitude and wave form which reduce directly into acoustic waves in the absence of gravity. While a number of characteristics are similar to the theory of small amplitude acoustic-gravity waves, these solutions exhibit features such as shock formation and phase dispersion which cannot be treated in small-amplitude theory. Solutions are given in terms of relations between physical wave characteristics and hydrodynamic variables. Comparison with traveling atmospheric disturbances are proposed. Author (GRA)

N72-19458# Development and Resources Transportation Co., Silver Spring, Md.
THE FEASIBILITY OF ADP OF AIRBORNE LINE SCAN IMAGERY FOR NEAR SHORE BATHYMETRY Technical Report, 1 Apr. - 1 Nov. 1971
Leonard A. LeSchack and D. E. McIvor Nov. 1971 27 p refs
(N00014-71-C-0327; NR Proj. 387-055)
(AD-734430; D/RT-6) Avail: NTIS CSCL 08/6

A study of the feasibility of applying automatic data processing techniques to airborne line-scan imagery of coastal areas for beach reconnaissance is presented. Preliminary work indicates that parallel microdensitometer scans of aerial photographs of a coastal area near Galveston, Texas, where ocean swell is visible, can be cross-correlated, both spatially and temporally, to extract wave length, wave angle, and wave speed.
Author (GRA)

N72-19459# Stanford Univ., Calif. Inst. for Plasma Research.
QUASI-LINEAR INTERACTION OF WHISTLER-MODE WAVES AND NON-THERMAL ELECTRONS Interim Report
P. C. W. Fung Nov. 1971 53 p refs
(Contract N00014-67-A-0112-0062; NR Proj. 323-009)
(AD-734435; SU-IPR-444) Avail: NTIS CSCL 04/1

In the paper the author attempts to analyze the quasi-linear cyclotron instability (under the weak turbulence regime) for whistler-mode waves due to pitch angle anisotropy of nonthermal electrons. The motivation of this study is to explain the triggered discrete VLF emissions occurring in the terrestrial magnetosphere. The time evolution of the growth rate and the induced waves spectrum for a loss cone type of nonthermal electrons is analyzed numerically. The diffusion of particles in pitch angles

due to quasilinear cyclotron instability is illustrated. It is shown that several major features of triggered VLF emissions can be explained by the stated instability. Some predictions of the theory is given and suggestions for further research are presented. Author (GRA)

N72-19460# Texas A&M Research Foundation, College Station.
RADIATIVE TRANSFER IN THE EARTHS ATMOSPHERE-OCEAN SYSTEM. 1: FLUX IN THE ATMOSPHERE AND OCEAN Technical Report, 15 Dec. 1970 - 14 Dec. 1971
Gilbert N. Plass and George W. Kattawar 14 Dec. 1971 33 p refs
(Contract N00014-68-A-0308-0002; A/M Proj. 700-16)
(AD-734413; A/M-Ref-71-26T) Avail: NTIS CSCL 04/1

The upward and downward flux at various levels in the atmosphere and ocean is calculated by a Monte Carlo method which includes all orders of multiple scattering. A realistic model of the atmosphere-ocean system is used. In the atmosphere, both Rayleigh scattering by the molecules and Mie scattering by the aerosols as well as molecular and aerosol absorption are included in the model. Similarly, in the ocean, both Rayleigh scattering by the water molecules and Mie scattering by the hydrosols as well as absorption by the water molecules and hydrosols are considered. Separate single scattering functions are calculated from the Mie theory for the aerosols and the hydrosols with an appropriate and different size distribution in each case. Author (GRA)

N72-19461# Texas A&M Univ., College Station.
RADIATIVE TRANSFER IN THE EARTHS ATMOSPHERE-OCEAN SYSTEM. 2: RADIANCE IN THE ATMOSPHERE AND OCEAN Technical Report, 15 Dec. 1970 - 14 Dec. 1971
George W. Kattawar and Gilbert N. Plass 14 Dec. 1971 53 p refs
(Contract N00014-68-A-0308-0002; A/M Proj. 700-16)
(AD-734414; A/M-Ref-71-27T) Avail: NTIS CSCL 04/1

In the first part of this paper N72-19460 Plass and Kattawar presented a method for the calculation of the radiation field in the earth:s atmosphere-ocean system. The solar photons are followed through the atmosphere and ocean by a Monte Carlo method which includes all orders of multiple scattering that make any noticable contribution to the detectors. In this second part the upward and downward radiance is presented as a function of the nadir or zenith angle for a number of different detector locations in the atmosphere and ocean. Once again the results are given for the three different ocean models of varying turbidity. The radiance is also given at six different wavelengths from 0.40 micrometer to 0.65 micrometer which are representative of varying degrees of scattering and absorption by the various components in the ocean. Author (GRA)

N72-19462# Naval Oceanographic Office, Washington, D.C. Applications Research Div.
BIRDS EYE 5-70, 4-14 NOVEMBER 1970
R. F. Freeman and H. J. Agee Oct. 1971 122 p
(AD-734157; NOO-IR-71-6) Avail: NTIS CSCL 08/12

BIRDS EYE 5-70 was a regularly scheduled Arctic Ocean ice reconnaissance mission covering the North American sector of the Arctic Ocean including Baffin Bay and Davis Strait from 4 to 14 November 1970. An airborne laser profilometer system was used continuously over the Arctic Ocean to obtain ice surface profiles. Ice observations were collected under daylight conditions in low latitudes and in twilight or moonlight in high latitudes. Author (GRA)

N72-19463# Naval Postgraduate School, Monterey, Calif.
SMALL COMPUTER ANALYSIS OF REGIONAL OCEAN DATA M.S. Thesis
Jaime Sanchez Cortes Sep. 1971 80 p refs
(AD-734974) Avail: NTIS CSCL 08/10

The study presents the results of an experiment in objective analysis of oceanographic data for a limited area. The objective analysis is designed to provide a reliable operational system for tactical use in coastal waters. It is shown that this approach makes it possible to obtain a very detailed analysis with good vertical consistency and that only a relatively small amount of highly accurate data is required. The procedure requires only a small computer and little computer time. This method will provide a basis for short-time forecasts of oceanographic parameters using only small computer centers or even time sharing systems. Author (GRA)

N72-19464# Texas A&M Univ., College Station. Dept. of Physics.
RESEARCH CONDUCTED THROUGH THE TEXAS A AND M RESEARCH FOUNDATION Final Report, 15 Dec. 1970 - 15 Dec. 1971
Gilbert N. Plass and George W. Kattawar 15 Dec. 1971 7 p
(Contract N00014-68-A-0308-0002)
(AD-734415; A/M-Ref-71-28T) Avail: NTIS CSCL 08/10

Research is reported on the following topics: multiple scattering of light from a laser beam in the ocean; Variation of the radiance in the ocean as a function of wavelength, variations in the turbidity of the ocean, and the zenith angle of the sun; Effect of various wave slope distributions on the radiance within the ocean and above the ocean; and Polarization of the radiation within the ocean. Author (GRA)

N72-19465# White Sands Missile Range, N.Mex. Atmospheric Sciences Lab.
OZONE: A SYNOPSIS OF ITS MEASUREMENT AND USE AS AN ATMOSPHERIC TRACER
Ralph D. Reynolds Aug. 1971 74 p refs
(DA Proj. 1T0-14501-B-53-A)
(AD-734818; ECOM-5401) Avail: NTIS CSCL 04/1

The purpose of the paper is to present in concise form a readily available reference of ozone for use in atmospheric physics research. The physical properties of ozone are discussed with emphasis primarily on its absorption characteristics. Methods of measuring ozone both directly and indirectly are given in detail. The secondary peak of ozone at 40 km that has been measured at White Sands Missile Range is presented. Regener sondes and Mast electrochemical sondes are compared, and the Mast equipment is expounded. Ozone is shown to be a good natural atmospheric tracer. Several possibilities are suggested for future research using ozone sondes. Author (GRA)

N72-19466# Arctic Inst. of North America, Washington, D.C.
REPORT OF ARCTIC OCEAN TECHNOLOGY WORKSHOP
John E. Sater Dec. 1971 53 p Conf. held at Warrenton, Va., Apr. 1971
(Contract N00014-70-A-0219-0001; Nr Proj. 307-105)
(AD-734683; AINA-TR-10) Avail: NTIS CSCL 08/10

The report is on a workshop held to stimulate wide discussion and innovative thought on available technology which could be useful to the Navy. Three broad areas were chosen for discussion: (1) the technology which supports science and exploration, (2) the technology which is used in transportation, communication, and logistics, and (3) the technology which is utilized or is presently feasible in resource exploitation. These areas were covered in detail to expose practical usage and limitations of the technology. Author (GRA)

N72-19467# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
EFFECT OF TURBULENT MOTIONS ON THE TRANSPORT OF MOLECULAR CONSTITUENTS WITH CHEMICAL REACTIONS IN THE UPPER ATMOSPHERE
C. M. Tchen (City Coll. of the City of N. Y.) Oct. 1971 27 p refs
(Contract DAHC15-67-C-0011)
(AD-734686; IDA/HQ-70-11859; P-698) Avail: NTIS CSCL 04/1

The photochemistry of the dissociation of molecular oxygen by sunlight and the subsequent recombination of the oxygen atoms is a very important process that largely determines the state of the normal atmosphere in the 80-1200-km altitude region, which in turn determines the state of the disturbed atmosphere. The paper addresses one aspect of the problem which has not been treated adequately, namely, the effect of turbulent motions of the ambient atmosphere on the transport of the species O and O2 when they undergo photochemical reaction. Author (GRA)

N72-19468# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SECULAR MAGNETIC VARIATION AND THE INNER PROTON BELT, APRIL - JUNE 1971
Michael Schulz and George A. Paulikas 1 Nov. 1971 18 p refs
(Contract F04701-71-C-0172)
(AD-734757; TR-0172(2260-20)-9; SAMSO-TR-71-258) Avail: NTIS CSCL 04/1

A comparison of characteristic time scales for the e-folding of proton energies suggests that the secular decrease of the geomagnetic dipole moment is a more important effect than radial diffusion over much of the inner zone. Author (GRA)

N72-19469# California Univ., Berkeley. Space Sciences Lab.
A SATELLITE SURVEY OF VECTOR ELECTRIC FIELDS IN THE IONOSPHERE AT FREQUENCIES FROM 10 TO 500 HERTZ. 1: ISOTROPIC, HIGH LATITUDE, LOW FREQUENCY EMISSIONS
Michael C. Kelley and Forrest S. Mozer 17 Dec. 1971 53 p refs
(Contract N00014-69-A-0200-1015)
(AD-735090; Ser-12-Issue-34) Avail: NTIS CSCL 04/1

Vector electric fields in the frequency range from 10 to 500 hertz have been measured on the 400 kilometer altitude polar orbiting OV1-17 satellite. Two distinct wave modes have been observed on every orbit and thus are characteristic of the ionosphere at 400 kilometers. The first of these modes is discussed in detail in this paper GRA

N72-19470# California Univ., Berkeley. Space Sciences Lab.
A SATELLITE SURVEY OF VECTOR ELECTRIC FIELDS IN THE IONOSPHERE AT FREQUENCIES FROM 10 TO 500 HERTZ. 2: THE ELECTRIC COMPONENT OF ELF HISS
Michael C. Kelly and Forrest S. Mozer 17 Dec. 1971 31 p refs
(Contract N00014-69-A-0200-1015)
(AD-735091; Ser-12-Issue-43) Avail: NTIS CSCL 04/1

The wave electric field experiment on the 400 kilometer polar orbiting OV1-17 satellite has observed two modes that are present in characteristic regions of every orbit in the measured frequency range of 12 to 500 hertz. One of these modes which is described in this, the second of a series of papers, is observed on closed magnetic field lines in the noon-midnight meridional plane. Author (GRA)

N72-19471# California Univ., Berkeley. Space Sciences Lab.
A SATELLITE SURVEY OF VECTOR ELECTRIC FIELDS IN THE IONOSPHERE AT FREQUENCIES FROM 10 TO 500 HERTZ. 3: LOW FREQUENCY EQUATORIAL EMISSIONS AND THEIR RELATIONSHIP TO IONOSPHERIC TURBULENCE
Michael C. Kelley and Forrest S. Mozer 17 Dec. 1971 25 p refs
(Contract N00014-69-A-0200-1015)
(AD-735092; Ser-12-issue-44) Avail: NTIS CSCL 04/1

Occasional observations of intense low frequency electric field fluctuations have been detected near the magnetic equator by the vector ac electric field experiment performed on the OV1-17 satellite which was in a circular polar orbit at an altitude of about 400 kilometers. The observed fluctuations are correlated with spread F at an equatorial ground station located near the projection of vehicle trajectory The observed fluctuations are correlated with spread F at an equatorial ground station located near the projection of the vehicle trajectory onto the surface of the earth. This correlation suggests that the ionospheric electric field turbulence is related to the modification of the propagation of radio waves resulting in scattering of the radio signals from irregularities of the medium. The polarization, intensity and spectral characteristics of the signal are similar to the high latitude low frequency electric fields detected on every orbit of OV1-17 and which were described in paper 1 of this series. Author (GRA)

N72-19472# Hydronautics, Inc., Laurel, Md.
SURFACE ROUGHNESS, SEA-SURFACE SLOPE AND WIND-WAVE SPECTRUM, SUPPLEMENT
Jin Wu Nov. 1971 12 p refs
(Contracts N00014-70-C-0345; Nonr-3688(00))
(AD-735094; TR-231-29-Suppl) Avail: NTIS CSCL 08/3

The measured mean square slope of the sea surface was shown to vary logarithmically with the wind velocity, and the rates of variation change with different boundary-layer regimes of the wind. Based on mean square slope data, the spectral constant of the directional wind-wave spectrum in the equilibrium range was considered to vary with wind regimes. The different rates of growth of slope with wind velocity is now interpreted as the result of the cutoff wave number extending into the capillary range at high wind velocities. Author (GRA)

N72-19473# Naval Oceanographic Office, Washington, D.C.
BIRDS EYE 2-71, 3-15 FEBRUARY 1971
M. R. Monroe and R. F. Freeman Nov. 1971 127 p
(AD-735115; NOO-IR-71-9) Avail: NTIS CSCL 08/12

BIRDS EYE 2-71 was a regularly scheduled Arctic Ocean ice reconnaissance mission covering areas east and west of Greeland between 3 and 15 February 1971. Ice observations were taken under daylight, twilight, or moonlight conditions. Poor weather and/or illumination restricted visibility to 4 km or less over 50 percent of the tracks. Author (GRA)

N72-19474# Agbabian-Jacobsen Associates, Los Angeles, Calif.
SPHERICAL WAVES IN A STRAIN-HARDENING MATERIAL Final Report, Feb. - Jul. 1971
Jeremy Isenberg and Anjan K. Bhaumik 28 Jul. 1971 33 p refs
(Contract DASA01-70-C-0065)
(AD-734695; AJA-R-7110-2001; DNA-2776F) Avail: NTIS CSCL 08/7

New constitutive equations are available for earth materials which appear to have theoretical advantages over previous models. The present work extends a previous study of spherical wave propagation in inelastic materials to a work-hardening material and compares the results. Author (GRA)

N72-19475# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
GEOELECTRIC AND GEOMAGNETIC STUDIES Final Report, 1961 -1970
Theodore R. Madden 14 Dec. 1971 30 p refs
(Contract Nonr-1841(75); NR Proj. 371-401)
(AD-734696; Rept-71-8) Avail: NTIS CSCL 08/7

A decade of ONR sponsored research work at M.I.T. in geoelectricity and geomagnetism is reviewed. The specific areas of study include crustal electrical resistivity, mantle resistivity and magnetotelluric and magnetic variation measurements, Schumann resonances of the earth-ionosphere cavity, Alfven wave phenomena in the magnetosphere, and computational and spectral analysis methods. A listing of personnel and publications is also included. Author (GRA)

N72-19476# Norwegian Defence Research Establishment, Kjeller.
NORSAR (NORWEGIAN SEISMIC ARRAY). PHASE 2: OPERATION AND MAINTENANCE Technical Report, 1 Dec. 1968 - 31 May 1969
Oct. 1971 24 p refs
(Contract F61052-68-C-0060; ARPA Order 800)
(AD-734749; NDRE-S-57; ESD-TR-71-392) Avail: NTIS CSCL 08/11

Project NORSAR concerns installation and operation of a large seismic array in S-E Norway. The report covers the operation (on site recording) and maintenance in the field during the period 1 December 1968 through 31 May 1969.
Author (GRA)

N72-19477# Naval Ordnance Lab., White Oak, Md.
SOME PERSPECTIVES AND RECENT FINDINGS IN SHALLOW WATER ACOUSTICS
Robert J. Urick 8 Nov. 1971 36 p
(AD-735108; NOLTR-71-204) Avail: NTIS CSCL 20/1

Shallow water acoustics has had in this country a long, though sporadic, history dating back to World War II, when the acoustic mine stimulated feverish activity in the subject. Yet, many aspects of this most difficult branch of underwater acoustics are not understood. Many of its complications are due to the temporal and spatial variability of the shallow water medium and its boundaries. For example, it was found that the transmission of shallow water sound will vary with direction and time at one location and to be different at apparently similar locations. Such variations make acoustic prediction difficult, and necessitate on-the-spot measurements at the place and time that data is required. To this end, the author had developed and tried out at a number of coastal locations an airborne method of data collection using sonobuoys, explosive sound signals, and simple, portable recording equipment.. The transmission results have been summarized by loss contour charts showing the transmission environment around a receiving point in shallow water.
Author (GRA)

N72-19478# Naval Postgraduate School, Monterey, Calif.
AN OBJECTIVE METHOD TO ANALYZE OCEANIC VARICLINES AND THEIR STATISTICAL RELATION TO SURFACE WINDS M.S. Thesis
Jose Manuel Pinto Bastos Saldanha Sep. 1971 208 p refs
(AD-734867) Avail: NTIS CSCL 08/10

Oceanographic and meteorologic data, namely expendable or mechanical bathythermograph traces and wind reports have been systematically collected for years and every day more observations are made. To handle such a large amount of information, it is advantageous to set up a computerized model which is: automatic; performs an objective analysis of XBT/BT traces to identify the most significant thermal features, such as thermoclines and inversions; restricts the human participation to an initial stage dealing with organization of data available and selection of proper values for the parameters of the model; and preserves the initial information.
Author (GRA)

N72-19479# Naval Postgraduate School, Monterey, Calif.
THE MECHANICAL DESIGN AND INSTRUMENTATION OF A FLOATING STABLE OCEANOGRAPHIC RESEARCH PLATFORM M.S. Thesis
Harro Heiner Siebert Sep. 1971 65 p refs
(AD-734866) Avail: NTIS CSCL 13/10

The Naval Postgraduate School plans to erect a floating stable oceanographic research platform in 240 ft. of water in Monterey Bay during the spring of 1972. The platform will use a multi-point mooring system and will have a minimum of five tons reserve buoyancy and a total weight of 11 tons. The criteria for selecting an optimum location for the platform are discussed and a selection is made based on a compromise of the various considerations. It is concluded that the best source of power should be a submarine cable from the shore because of the five year minimum life expectancy of the platform. The initial set of permanently installed sensors should include instruments to measure basic parameters in the areas of Meteorology, Oceanography and Ocean Engineering.
Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-19480*# Alabama Univ., University. Bureau of Engineering Research.
NEAR FIELD ANTENNA PATTERNS OF OBSTRUCTED CASSEGRAINIAN TELESCOPES Interim Progress Report
William E. Webb Jan. 1972 57 p refs
(Contract NAS8-25562)
(NASA-CR-123548; BER-143; IPR-2) Avail: NTIS CSCL 17H

The near field antenna pattern of an obstructed optical transmitter, such as a Cassegrainian telescope, has been computed using the Fresnel approximation to the scalar diffraction integral. A number of cases have been considered. These include uniformly illuminated, obstructed circular apertures, and apertures coherently illuminated with a divergent gaussian beam wave. Other beam profiles that may be derived by energy redistribution of the laser beam have also been considered. The techniques used for the numerical evaluation of the Fresnel integral are discussed and results for the optical systems to be used on the High Altitude Aircraft Optical Communications Experiment are presented.
Author

N72-19481*# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
THE FEASIBILITY STUDY FOR ELECTRONIC IMAGING SYSTEM WITH THE PHOTOHELIOGRAPH Final Report, Feb. 1971 - Jan. 1972
E. L. Svensson and F. L. Schaff 7 Feb. 1972 168 p refs
(Contract NASw-2184)
(NASA-CR-125690) Avail: NTIS CSCL 14B

The development of the electronic subsystems used for the photoheliograph and its application for a high resolution study of the sun are discussed. Basic considerations are as follows: (1) determination of characteristics of solar activity within the spectral response of the photoheliograph, (2) determination of the space vehicles capable of carrying the photoheliograph, (3) analysis of the capability of the ground based data gathering network to assimilate the generated information, and (4) the characteristics of the photoheliograph and the associated spectral filters.
Author

N72-19482*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DEVELOPMENT OF AN INHERENTLY DIGITAL TRANSDUCER
Richard R. Richard Washington Mar. 1972 17 p refs
(NASA-TN-D-6694; MSC-S-263) Avail: NTIS CSCL 14B

The term digital transducer normally implies the combination of conventional analog sensors with encoders or analog-to-digital converters. Because of the objectionable characteristics of most digital transducers, a program was instituted to investigate the possibility of producing a transducer that is inherently digital, instead of a transducer that is digital in the usual sense. Such a device would have improved accuracy and reliability and would have reduced power and bulk requirements because two processes, sensing and conditioning, would be combined into one processes. A Curie-point-temperature sensor is described that represents realization of the stated goal. Also, a metal-insulator semiconductor is described that does not conform precisely to the program

goals but that appears to have applications as a new and interesting transduction device. Author

N72-19483# Advisory Group for Aerospace Research and Development, Paris (France).
AVIONICS IN SPACECRAFT
Ph. Hartl and John E. Twinn, eds. Sep. 1971 349 p refs Proc. of the 220 Tech. Symp. of the Avionics Panel of AGARD, Rome, 31 May-4 Jun. 1971
(AGARD-CP-87-71) Avail: NTIS HC $6.00/MF $0.95

The proceedings of a conference on avionics for spacecraft are presented. Subjects discussed are: (1) microelectronic equipment, (2) semiconductor devices, (3) attitude control systems, (4) remote sensors, (5) data processing equipment, (6) satellite communications, and (7) design of telemetry and telecommand links for interplanetary space probes. A total of 31 papers was presented. For individual titles, see N72-19484 through N72-19514.

N72-19484# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Avionics Lab.
MICROELECTRONICS FOR AEROSPACE SYSTEMS c26
H. V. Noble *In* AGARD Avionics in Spacecraft Sep. 1971 11 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The reasons for the entry of the USAF into microelectronics, some significant recent achievements, and predictions of microelectronic devices that will be available for aerospace systems for the 1975-1980 time period are presented. These predictions are based on the extension of advances made during the past few years plus estimates of results of current and future USAF programs. The following types of devices are covered: (1) digital and analog circuit devices for computer and data processing, (2) integrated microwave devices for both receivers and transmitters, (3) integrated circuit devices for high data rate transmission, (4) integrated circuit - antenna arrays, and (5) size reduction possibilities for computers based on use of advanced microcircuits. Author

N72-19485# Royal Aircraft Establishment, Farnborough (England). Space Dept.
HYBRID MICROCIRCUIT TECHNOLOGY IN THE BRITISH NATIONAL SPACE PROGRAM c10
H. D. Fisher *In* AGARD Avionics in Spacecraft Sep. 1971 15 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

Experimental equipment to be flown on the X3 satellite in the British national space program is discussed. Arguments are presented in support of the use of hybrid microcircuits for very high quality, low volume production of electronic circuits. The current techniques are described and reasons for the choice of technologies are given. Process and component yields are examined. Author

N72-19486# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
CIRCUIT DESIGN FOR SPACECRAFTS WITH COMPLEMENTARY MOS INTEGRATED CIRCUITS c10
W. Schambeck *In* AGARD Avionics in Spacecraft Sep. 1971 10 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The application of complementary metal oxide semiconductors (C-MOS) to spacecraft and commercial equipment is discussed. The use of C-MOS for electronic clocks and portable instrumentation is described. The advantages resulting from low power dissipation and high circuit flexibility of C-MOS circuits are examined. Some of the special considerations required in the design and operation of C-MOS circuits are explained. Author

N72-19487# Communications Research Centre, Ottawa (Ontario).
AN IMPROVED APPROACH TO SELECTION OF HIGH RELIABILITY SEMICONDUCTOR COMPONENTS FOR SATELLITE PROGRAMS c26
A. R. Molozzi and R. F. Haythornthwaite *In* AGARD Avionics in Spacecraft Sep. 1971 7 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

Selection procedures to improve the quality of semiconductor devices used on the Alouette-ISIS satellite program are discussed. The lack of reliability inherent in mass production of semiconductors and the impact on the design of satellites with five to ten year life span is described. The method for choosing semiconductor devices in order to obtain maximum component reliability is presented. The interrelation of circuit design and component selection is examined. Author

N72-19488# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Satellitenelektronik.
SOME NOVEL METHODS IN FAILURE ANALYSIS c15
E. Ress and G. Ress *In* AGARD Avionics in Spacecraft Sep. 1971 12 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

Methods of conducting failure analysis of integrated circuits are discussed. The application of scanning electron microscopy for nondestructive tests in failure analysis is described. The modes in which the scanning electron microscope is used are presented. The types of failures which the scanning electron microscope is capable of detecting are described. Author

N72-19489# Montecatini Edison S.p.A., Milan (Italy).
INTEGRATED CHECK-OUT SYSTEM FOR SPACE LAUNCHERS AND AIRCRAFT SYSTEMS c10
Mauro Falleni *In* AGARD Avionics in Spacecraft Sep. 1971 16 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

A completely integrated system capable of performing all the necessary operations for the check-out of space launchers of the 1970's generation and for aircraft systems is described. It is to be considered as a general purpose system. Any kind of real-time operation necessary for check-out operations and all the post-flight computation can be carried on without external aids. The general philosophy of its conception is such that certain attributes such as simplicity, modularity, minimum specialization allow for the widest possibility of efficiency and expansion possibly required for future, more elaborated check-out procedures. A number of degraded levels of operation is allowed, the lowest of them being the manual operation level, in order to face different emergency situations. Special consideration has been given to the man-machine relationships and to the efficiency of maintenance and repair operations. Author

N72-19490# Montecatini Edison S.p.A., Milan (Italy).
CONSIDERATIONS ON A SUBSYSTEM FOR HANDLING COMMANDS AND STIMULI FOR AN INTEGRATED AND AUTOMATIC CHECK OUT OF SPACE LAUNCHERS c11
Mauro Falleni *In* AGARD Avionics in Spacecraft Sep. 1971 19 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

A description of the stimuli and commands subsystem for the EUROPA 3 launch vehicle is presented. A description of the organization and functions of the system is given. Data transmission format and message structure are examined. The required circuits for handling the data flow are presented. Problems concerning the reliability of transmitting and executing a stimulus and/or a command are analyzed and partially solved. Other aspects of the interfaces between this subsystem and the other part of either the checkout system or the vehicle have been considered and solved in reasonable detail. Author

N72-19491# Philips Gloeilampenfabrieken N. V., Geldrop (Netherlands).
ANS ATTITUDE CONTROL SUB-SYSTEMS
P. VanOtterloo *In* AGARD Avionics in Spacecraft Sep. 1971

10 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The attitude control subsystem and onboard computer for the ANS satellite are discussed. The ANS is an astronomical satellite for ultraviolet and X-ray measurements in space. A description of the satellite is presented. The requirements of the attitude control subsystem and the onboard computer are analyzed. The subsystems are described and their various modes of operation are examined. Author

N72-19492# Selenia S.p.A., Rome (Italy).
THREE AXIS R.F. ATTITUDE SENSOR OF A GEOSTATIONARY SATELLITE
Benito Palumbo *In* AGARD Avionics in Spacecraft Sep. 1971 17 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

A three axis radio sensor for satellite application is described. The system measures the attitude error of a three-axis stabilized geostationary satellite with respect to an earth station that transmits a RF beacon signal. A phase comparison two-dimensional system on-board the satellite is used for measuring the pitch and roll errors. The error around the yaw axis is obtained by comparing the orientation of the linear polarization of the on-board antennas with the polarization plane of the ground transmitted signal. The system and the design criteria of the components are presented. The pointing error sources are analysed and the accuracy of the system is evaluated. The required characteristics of the ground station are indicated with reference to the system operation. Author

N72-19493# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
THE DRALLRAD: A FLYWHEEL FOR THE STABILIZATION OF SYNCHRONOUS SATELLITES
Heinz Wehde *In* AGARD Avionics in Spacecraft Sep. 1971 7 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The application and operation of flywheels for stabilization of synchronous satellites is discussed. Optimal relations between angular momentum, size, and weight are calculated. Rules for the use of ball bearings are established. The characteristics of a brushless, dc motor with optical commutation and permanent magnet excitation are described. The electrical and mechanical results obtained from various configurations are summarized. Author

N72-19494# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
ELECTRONICS OF A MASS SPECTROMETER
V. Gerber *In* AGARD Avionics in Spacecraft Sep. 1971 7 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

A quadrupole mass spectrometer consisting of an ion source, mass analyzer, multiplier, and associated electronics is described. The mass spectrometer will measure the absolute abundances of neutral atmospheric constituents and the relative composition of ambient ions. The various atmospheric parameters which can be determined by combined data from the mass spectrometer, impedance probe, retarding potential, and neutral atmospheric temperature experiments are discussed. Author

N72-19495# Marconi Space and Defence Systems, Ltd., Frimley (England).
METHODS OF IDENTIFICATION OF THE EARTHS HORIZON AND EXAMPLES OF APPLICATION TO ATTITUDE DETERMINATION OF SPACECRAFT c21
G. G. Fuller and M. L. Reynolds *In* AGARD Avionics in Spacecraft Sep. 1971 9 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The attitude determination of earth orbiting satellites by sensing earth radiation is discussed. Various classes of missions and their relation to the different classes of earth sensors are examined. The earth's radiant field for visible and middle infared wavelengths is described. Examples of several missions are presented and the sensors designed to fulfill the requirements of each mission are analyzed. Author

N72-19496# Officine Galileo S.p.A., Florence (Italy).
SENSORS OF THE EARTH INFRARED HORIZON AND SOLAR SENSORS FOR SATELLITE ATTITUDE DETERMINATION
R. Baldassini Fontana *In* AGARD Avionics in Spacecraft Sep. 1971 10 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

An analysis is presented of a sensor system to be placed on board of a geostationary spinning satellite for the purpose of determining the satellite attitude during the transfer and final orbit. The system consists of sensors of earth infrared horizon and sun sensors. The magnitudes to be observed and the type of information to be obtained in connection with the operational conditions, are analyzed. In addition, the results of the computations developed to optimize the parameters of the sensors and to establish the system accuracy, are described. Author

N72-19497# Officine Galileo S.p.A., Florence (Italy).
SCANNING RADIOMETERS FOR METEOROLOGICAL SATELLITE
V. Rizzo *In* AGARD Avionics in Spacecraft Sep. 1971 11 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The characteristics of imaging radiometers for mechanical scanning from a satellite platform in the infrared and visible spectra are discussed. A survey of the experimental objectives and their influence on the choice of spectral band to be used is presented. The trade-off between quality of picture and physical properties of the radiometer are examined. A typical instrument is shown in order to describe the nature of its operation. Author

N72-19498# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
SATELLITE TELEVISION SYSTEM c07
O. Hofmann *In* AGARD Avionics in Spacecraft Sep. 1971 11 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The operating principles of a satellite television recording system with no moving mechanical parts are presented. The television recording is performed by continuous line scanning with constantly open aperture. The scanning line is divided by several mirror strips and led to vidicons. By insertion of prisms, the line sections can be dispersed spectrally. The essential characteristics of the system with emphasis on stereoscopic recording are described. Author

N72-19499# Royal Aircraft Establishment, Farnborough (England).
AN EXPERIMENTAL CANOPUS STAR SENSOR
P. Haskell *In* AGARD Avionics in spacecraft Sep. 1971 13 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The Canopus star sensor and its application to the stabilization of the X4 technology satellite are discussed. The modes of operation performed by the spacecraft to check the parameters of the sensor are explained. Subsidiary experiments which may be conducted by the sensor during the mission are examined. Author

N72-19500# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE USE OF VISIBLE LIGHT SENSORS IN SPINNING SATELLITE CONTROL SYSTEMS
F. Williams Sarles, Jr. *In* AGARD Avionics in Spacecraft Sep. 1971 8 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The application of visible light sensors in spinning satellite control systems launched during the Lincoln Experimental Satellite (LES) program is discussed. Earth location information use in either an intermittent or continuous sensing operation is described. It is concluded that an accuracy of one tenth of a degree should be realizable in circular, synchronous, near-equatorial orbits.

Author

N72-19501# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

THE APPLICATION OF COMPLEMENTARY MOS CIRCUITS IN PCM SYSTEMS AS A QUALIFICATION TEST **c10**

Manfred Mozer *In* AGARD Avionics in Spacecraft Sep. 1971 6 p refs (See N72-19483 10-14)

Avail: NTIS HC $6.00/MF $0.95

Two electronical devices, which are implemented with complementary MOS-circuits are described. One of these systems was part of an ESRO-payload, by the aid of which photographic and photometric measurements in the soft X-ray region had been carried out during a sounding-rocket flight. The aim of the experiment was an investigation of the sun corona. The electronical subsystem of the experiment had been developed for the measurement of the intensity of five emission-lines and for the conversion of these results into a PCM-signal. The second device is a quartz-clock with a PCM-output, which is installed in a recording current meter for an application in oceanography. It is specified for a very low power consumption and has to demonstrate the long-life qualities of complementary MOS-circuits, for the undersea current meter is expected to have a lifetime of one year. Due to this long time and due to the necessity of low power consumption, the seaprobe is an ideal platform for a qualification test of components, which are provided for an application in spacecrafts. Though both devices have been developed as functional support for other experimenters, they are technological experiments of our institute and part of our activities, to test and to introduce new components. Author

N72-19502# Royal Aircraft Establishment, Farnborough (England). Space Dept.

DATA STORAGE FOR SMALL SCIENTIFIC SPACECRAFT **c08**

A. C. Christmas and A. H. Spooner *In* AGARD Avionics in Spacecraft Sep. 1971 5 p (See N72-19483 10-14)

Avail: NTIS HC $6.00/MF $0.95

The reasons for on-board data storage are considered together with the type of storage necessary. This covers spacecraft status, continuously changing experiments, survey or totalising experiments and the organization of data into a form which is suitable for storage. These considerations together with telemetry and ground receiver requirements effectively specify the performance of a data storage system. Practical examples are given showing how the requirements have been met. The development, testing and orbital performance of an endless loop tape recorder, including the mechanical techniques used to meet the reliability, power and flutter requirements are described. Future needs are considered and compared with possible developments to give a forecast of the type of data storage which will be employed in later spacecraft. Author

N72-19503# Royal Aircraft Establishment, Farnborough (England).

A MODULAR SPACECRAFT PCM DATA CONDITIONING SYSTEM **c08**

L. Smith and K. McDonald (Marconi Space and Defense Systems, Ltd.) *In* AGARD Avionics in Spacecraft Sep. 1971 17 p refs (See N72-19483 10-14)

Avail: NTIS HC $6.00/MF $0.95

The PCM system developed for encoding and formatting data on board spacecraft is described. A set of standard modules has been designed which can be arranged in various ways to meet the many demands presented by the program. Within each module components are welded either to a nickel wire or a nickle-mylar interconnection matrix and then encapsulated to form slim cards. These are assembled and wire-wrapped to a back panel to produce functional units such as an encoder or decoder. Integrated circuits, purchased to in-house specifications which call for 100% inspection at all stages of manufacture and test, have been used wherever possible. The system accepts data in 3 forms: (1) digital in parallel or (2) serial form, and (3) analogue in the range plus or minus 5 volts. The analogue data is converted into 8 bit words prior to insertion into the main data stream. The maximum rate is 8,000 samples/sec which corresponds to a bit rate of 64 kHz. System feasibility was demonstrated using a prototype model and this has been developed and engineered into fully operational X3 system.

Author

N72-19504# Standard Electrik Lorenz A. G., Stuttgart (West Germany).

PROGRAMMABLE PCM TELEMETRY ENCODER FOR SPACE APPLICATIONS **c07**

D. Pabst *In* AGARD Avionics in Spacecraft Sep. 1971 4 p (See N72-19483 10-14)

Avail: NTIS HC $6.00/MF $0.95

The function of the programmable PCM-Encoder in controlling the data handling necessary for transmission is discussed. The programmability has many advantages, since the specifications change from mission to mission. There are pre-wired and programmable functions. The generation of the control data will be achieved by a device within the encoder, very similar to a small computer. The program loading technique is compatible with nearly all command systems. The weight of an encoder is within the range of 1 to 3 kg, the power consumption varies from 1 to 4 watts depending on the bitrate. Author

N72-19505# Marconi Space and Defence Systems, Ltd., Portsmouth (England).

USE OF COMPUTERS FOR REAL TIME SATELLITE CHECKOUT **c08**

M. A. Skinner *In* AGARD Avionics in Spacecraft Sep. 1971 5 p (See N72-19483 10-14)

Avail: NTIS HC $6.00/MF $0.95

The application of computers for automatic testing and data processing during the checkout of satellites is discussed. The rationale for selecting a digital computer for data processing and automatic control is explained. The requirement for the checkout to encompass all performance parameters and the amount of time required form the basis for computer use. The skills required to produce and use a computer controlled checkout system are examined. Author

N72-19506# IBM Italia, Rome.

AN APPROACH TO NATURAL LANGUAGE FOR COMMAND AND CONTROL SYSTEMS **c07**

A. Lanzara *In* AGARD Avionics in Spacecraft Sep. 1971 9 p refs (See N72-19483 10-14)

Avail: NTIS HC $6.00/MF $0.95

The development of a user-oriented language for effective man machine communication is discussed. The feasibility of such a language for command and control purposes is examined. Different language models are analyzed and the basis for selection is explained. The influence of batch processing and on-line processing on the selection of the appropriate language is described. Author

N72-19507# Lincoln Lab., Mass. Inst. of Tech., Lexington.

A VARIABLE COVERAGE SATELLITE ANTENNA SYSTEM **c07**

A. R. Dion and L. J. Ricardi *In* AGARD Avionics in Spacecraft Sep. 1971 13 p refs (See N72-19483 10-14)

Avail: NTIS HC $6.00/MF $0.95

A multi-beam antenna system and combiner switch capable of producing a variable-coverage radiation pattern are described. The antenna consists of a waveguide lens illuminated by a 19-element feedhorn array. The combiner switch consists of a

corporate arrangement of variable power dividers; the latter is made up of two phase shifters and two conventional hybrid power dividers. An earth-coverage radiation pattern with less than 2-dB ripple and an antenna gain of 20 dB is obtained by equally exciting all beams of the multi-beam antenna simultaneously. Excitation of a single feedhorn results in a narrow beam with an antenna gain of 30 dB and a near-in side-lobe level less than minus 20 dB. The side-lobe level can be reduced appreciably by appropriately exciting the adjacent feedhorns. The frequency bandwidth corresponding to 0.5 dB decrease in antenna gain is 10 percent. A technique for computing the radiation properties of the antenna is described.
Author

N72-19508# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
DESIGN OF TELEMETRY AND TELECOMMAND LINKS FOR INTERPLANETARY SPACE PROBES c07
E. Stolle *In* AGARD Avionics in Spacecraft Sep. 1971 16 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The concept of spacecraft/earth telecommunication links is presented, and various system parameters with their influence on link performance are discussed. Of particular interest are: (1) power division between carrier and sidebands; (2) modulation indices; (3) demodulation/detection losses of RF receiver; (4) subcarrier demodulator; (5) bit synchronizer; (6) number of subcarriers, and parameter tolerances. The design criteria such as data rate, bit error rate, and spacecraft effective radiated power are discussed. An optimization method is given, based on a criterion of minimum required total signal-to-noise ratio at the receiver. Examples from the link design for the HELIOS solar probe demonstrate the practicality of the approach. Author

N72-19509# Royal Aircraft Establishment, Farnborough (England).
SOME ASPECTS OF MULTIPATH FADING IN AERONAUTICAL SATELLITE SYSTEMS c07
M. J. Sidford *In* AGARD Avionics in Spacecraft Sep. 1971 15 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

Information is presented which allows estimates to be made of the amplitudes and frequencies of the fades which occur in a satellite-to-aircraft radio link due to interference between the direct waves and those reflected from the earth's surface. A wide range of conditions is covered involving reflecting surface properties, frequency and polarisation of the radio waves, aircraft antenna radiation pattern, and satellite elevation angle. Experimental evidence of multipath fading over sea and ice is included, and recommendations are made for the aircraft aerial characteristics required to reduce this fading. Author

N72-19510# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
RANGING TRANSPONDERS FOR INTERPLANETARY SPACE PROBES c07
H. Bassenberg and R. Stoiber *In* AGARD Avionics in Spacecraft Sep. 1971 12 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

Different concepts such as direct amplification, use of doublers and triplers in solid state power amplifiers at 2.3 GHz with power output up to 20 W are discussed. The important characteristics values of a doubler concept are measured with a test set up of 1.15 GHz stripline amplifier using the power transistor 2N5921. Furthermore versions of cavity- and stripline doublers using varactors MA 43000, MA 4B 300, BXY 19 GB and stripline power dividers and combiners are discussed. Power chains connected in parallel make possible a 20 W amplifier at 2.3 GHz with a total efficiency of better than 30 percent.
Author

N72-19511# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFICIENT X-BAND POWER GENERATION FOR SATELLITE COMMUNICATIONS c07
D. M. Snider *In* AGARD Avionics in Spacecraft Sep. 1971 9 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The efficient generation of solid state X-band power by utilizing the negative impedance characteristics of avalanche diodes in reflection amplifiers is discussed. Circuits with low level gains of 13 db with 500 mc bandwidth are described. Power outputs of one watt continuous wave, with 5 db gain and 20 percent conversion efficiency in the same circuit are examined. Gain response curves for gallium arsenide diodes are included.
Author

N72-19512# Royal Aircraft Establishment, Farnborough (England).
MEASUREMENT OF ANTENNA RADIATION PATTERNS ON SPACECRAFT c07
A. Stembridge *In* AGARD Avionics in Spacecraft Sep. 1971 11 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The measurement of antenna radiation patterns on spacecraft telemetry and telecommand antennas operating in the VHF (136 - 149 MHz) and UHF (435 - 470 MHz) frequency ranges is discussed. Measurements have been carried out on out-door ranges by full scale and model techniques which are described. Facilities for making measurements have been limited to models weighing less than 100 lb. A new facility, now under construction, using improved techniques and capable of handling models up to 500 lb in weight is described. General techniques and methods of presenting results are explained and typical antenna radiation patterns are given. Some comments on merits of anechoic chamber and out-door methods of measurement are made.
Author

N72-19513# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AUTOMATIC TRACKING OF Q-SWITCHED LASER RANGEFINDERS c16
Roland Moreau *In* AGARD Avionics in Spacecraft Sep. 1971 12 p refs In FRENCH; ENGLISH summary (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The automatic tracking of Q-switched laser rangefinders is discussed. Subjects presented are: (1) programmed tracking through ephemerides, (2) independent tracking using cartometric data, and (4) semiautomatic tracking. The acquisition period for each system is studied with emphasis on twenty four hour satellites. The effect of the pulse frequency is analyzed when there is a partially random displacement of the target. Author

N72-19514# Royal Aircraft Establishment, Farnborough (England).
CHIRP MODULATION SYSTEM IN AERONAUTICAL SATELLITES c07
G. W. Barnes, D. Hirst, and D. J. James *In* AGARD Avionics in Spacecraft Sep. 1971 10 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

The advantages of chirp modulation for air/ground digital communication by way of geostationary satellites are described. The effectiveness in reducing multipath reception and Doppler frequency shifts is discussed. The contribution of chirp modulation to reducing the limitations of marginal power budgets on satellite to aircraft links is examined. Flight tests of experimental systems are included. Author

N72-19515*# National Aeronautics and Space Administration, Washington, D.C.
TESTING METHODS AND TECHNIQUES: TESTING ELECTRICAL AND ELECTRONIC DEVICES: A COMPILATION

1972 27 p
(NASA-SP-5943(01)) Avail: NTIS; HC $1.00/MF $0.95 CSCL 14B

The methods, techniques, and devices used in testing various electrical and electronic apparatus are presented. The items described range from semiconductor package leak detectors to automatic circuit analyzer and antenna simulators for system checkout. In many cases the approaches can result in considerable cost savings and improved quality control. The testing of various electronic components, assemblies, and systems; the testing of various electrical devices; and the testing of cables and connectors are explained. Author

N72-19516*# Honeywell, Inc., Minneapolis, Minn. Aerospace Div.
ATTITUDE-REFERENCED RADIOMETER STUDY. PART 2: PRIMARY CALIBRATION SYSTEM
William R. Williamson and Allen A. Otte Washington NASA Dec. 1971 131 p refs
(Contract NAS1-8801)
(NASA-CR-1902) Avail: NTIS CSCL 14B

A primary calibration system, PCS, for infrared radiometers has been developed, built, and tested. The system allows radiometers to be calibrated with less than 1 percent error for use in earth coverage horizon measurements, earth resources surveys, and synoptic meteorological measurement. The final design, fabrication and test of the PCS are reported. A detailed description of the PCS construction is presented, along with the results of a complete series of functional tests. Test to verify the source thermal characteristics, collimator reflectance, and output beam characteristics are described and their results presented. Author

N72-19517*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A RADAR ALTIMETER-DRIFTMETER FOR SMALL PLANETARY PROBES
J. W. Bryan Dec. 1971 18 p
(NASA-TM-X-65837; X-551-71-512) Avail: NTIS CSCL 22B

A light weight radar altimeter-driftmeter applicable to landing planetary probes is described. The system utilizes a small light weight phased array antenna to generate three independent radio frequency beams. The range and Doppler along each of these beams is measured. The six measured quantitites are then combined with a resulting range (altitude) accuracy of 75 meters and a horizontal drift velocity accuracy of 6 cm/sec. The entire system weighs less than 3.7 kilograms and requires less than 9 watts of dc power. Author

N72-19518*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF RADIOMETRIC ERRORS ON ACCURACY OF TEMPERATURE-PROFILE MEASUREMENT BY SPECTRAL SCANNING USING ABSORPTION-EMISSION PYROMETRY
Donald R. Buchele Washington Mar. 1972 25 p refs
(NASA-TN-D-6726; E-6289) Avail: NTIS CSCL 14B

The spectral-scanning method may be used to determine the temperature profile of a jet- or rocket-engine exhaust stream by measurements of gas radiation and transmittance, at two or more wavelengths. A single, fixed line of sight is used, using immobile radiators outside of the gas stream, and there is no interference with the flow. At least two sets of measurements are made, each set consisting of the conventional three radiometric measurements of absorption-emission pyrometry, but each set is taken over a different spectral interval that gives different weight to the radiation from a different portion of the optical path. Thereby, discrimination is obtained with respect to location along the path. A given radiometric error causes an error in computed temperatures. The ratio between temperature error and radiometric error depends on profile shape, path length, temperature level, and strength of line absorption, and the absorption coefficient and its temperature dependency. These influence the choice of wavelengths, for any given gas. Conditions for minimum temperature error are derived. Numerical results are presented for a two-wavelength measurement on a family of profiles that may be expected in a practical case of hydrogen-oxygen combustion. Under favorable conditions, the fractional error in temperature approximates the fractional error in radiant-flux measurement. Author

N72-19519# Pennsylvania Univ., Philadelphia. Towne School of Civil and Mechanical Engineering
CONTINUUM ANALYSIS OF THE PHOTOIONIZATION CHAMBER IN THE TRANSITION FROM FREE TO AMBIPOLAR DIFFUSION
Andrew B. Wardlaw, Jr. and Ira M. Cohen Feb. 1972 55 p refs
(Grant NSF GK-2281)
(Rept-2281/4) Avail: NTIS

The particle densities and electric field distributions as well as the current-voltage characteristic are studied in a photoionization chamber consisting of a test gas bounded by parallel plates and ionized to a small extent by incident radiation. The charged particles formed by the ionization process diffuse to the walls of the chamber where they recombine. At low levels of ionization the electron density is neglected with respect to the ion density. Coupling this simplification with correct scaling it is possible to obtain analytic solutions. The resulting current-voltage characteristic reflects the rate of ionization as well as the ratio of the ion to the electron temperature. When this ratio is equal to unity the ion and electron current fluxes saturate at the same rate. If this ratio is less than unity the electron current flux saturates more slowly than the ion current flux. At higher levels of ionization the electron density can no longer be neglected with respect to the ion density and the problem is solved numerically. The current-voltage characteristic obtained in this case can be approximated analytically at small and large voltages. The expression which applies for small voltages agrees with the results of other double probe studies. Author

N72-19520*# Battelle Memorial Inst., Columbus, Ohio.
NONCONTACTING DEVICE TO INDICATE DEFLECTION OF TURBOPUMP INTERNAL ROTATING PARTS Quarterly Report
D. B. Hamilton, D. R. Grieser, A. M. Plummer, Dale Ensminger, and E. J. Saccacio 15 Mar. 1972 55 p
(Contract NAS8-26903)
(NASA-CR-123565; QR-4) Avail: NTIS CSCL 14B

Phase 2 (development) which was concluded for the ultrasonic Doppler device and the light-pipe-reflectance device is reported. An ultrasonic Doppler breadboard system was assembled which accurately measured runout in the J-2 LOX pump impeller during operation. The transducer was mounted on the outside of the pump volute using a C-clamp. Vibration was measured by conducting the ultrasonic wave through the volute housing and through the fluid in the volute to the impeller surface. The impeller vibration was also measured accurately using the light-pipe probe mounted in an elastomeric-gland fitting in the pump case. A special epoxy resin developed for cryogenic applications was forced into the end of the fiber-optic probe to retain the fibers. Subsequently, the probe suffered no damage after simultaneous exposure to 2150 psi and 77 F. Preliminary flash X-radiographs were taken of the turbine wheel and the shaft-bearing-seal assembly, using a 2-megavolt X-ray unit. Reasonable resolution and contrast was obtained. A fast-neutron detector was fabricated and sensitivity was measured. The results demonstrated that the technique is feasible for integrated-time measurements requiring, perhaps, 240 revolutions to obtain sufficient exposure at 35,000 rpm. The experimental verification plans are included. Author

N72-19521# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
A MONTE-CARLO CODE FOR THE EVALUATION OF THE EFFICIENCY OF A B-NaI NEUTRON COUNTER
V. Brandl Dec. 1970 37 p refs Transl. into ENGLISH of

German rept. KFK-1182 Sponsored by AEC-EURATOM Fast Reactor Exchange Program
(EURFNR-901; KFK-1182) Avail: NTIS

The counter described detects 478-keV gamma rays from the sequence of reactions: B-10 + n = Li*-7 + alpha + 2.3 MeV; Li*-7 yields Li-7 + gamma + 478 keV. Multiple elastic scattering of the neutrons on B-10 and (CH2) sub n is taken into account. For an arbitrary energy group of neutrons, the detector's efficiency was evaluated by a Monte Carlo analog. In all other energy groups, the efficiency was simultaneously computed by sampling corresponding weights. The most important input data of the code are the geometry of the counter and the nuclear cross sections of its constitutents. Author (NSA)

N72-19522# Bendix Corp., Kansas City, Mo.
PHOTOGRAMMETRIC GAGING
Jun. 1971 121 p
(Contract AT(29-1)-613)
(BDX-613-547) Avail: NTIS

The development of equipment and techniques for non-contact dimensional gaging of parts made from sensitive materials and parts with delicate surface finishes is discussed. The application of photogrammetric techniques to dimensional inspection is described. Advantages and limitations of photogrammetric methods for making dimensional measurements are examined and the state of the art capabilities of this technique are determined. It is concluded that photogrammetric methods offer an attractive combination of accuracy, speed, and versatility, and may be advantageously used in certain industrial inspection applications. Author

N72-19523# Atlantic Richfield Hanford Co., Richland, Wash.
ANTICOINCIDENCE GUARDED, Ge(Li) DETECTOR FOR ENVIRONMENTAL LEVEL GAMMA ENERGY ANALYSIS
William H. Zimmer Sep. 1971 11 p refs Presented at Nucl. Sci. Symp., San Francisco, Calif., 3 Nov. 1971
(Contract AT(45-1)-2130)
(ARH-SA-101; Conf-711111-8) Avail: NTIS

The environmental level gamma energy system consists of a single, large volume Ge(Li) detector with an NaI(Tl) anticoincidence guard, all operating in a laminar flow clean room. A peak height-to-Compton edge ratio of better than 250:1, together with a reducing background, enables analysis of sample volumes from point sources to 700 cc. Author (NSA)

N72-19524# Oak Ridge National Lab., Tenn.
COMBINED GAS CHROMATOGRAPHY-MASS SPECTROMETRY FOR THE IDENTIFICATION OF COMPOUNDS OF BIOLOGICAL INTEREST
W. T. Rainey, W. C. Butts, M. R. Guerin, and F. Snyder [1971] 20 p Presented at 15th Conf. on Analytical Chem. in Nucl. Technol., Oak Ridge, Tenn., 12 Oct. 1971
(Conf-711024-1) Avail: NTIS

A gas chromatograph inlet system has been added to the single stage mass spectrometer which is used for routine organic analysis. Adequate sensitivity and enrichment have been obtained using a porous stainless steel helium separator between the GC and mass spectrometer. The combined system has been of great value in analysis of impure samples, since the chromatograph allows introduction of individual components into the ion source. Samples obtained from the Body Fluids Analysis Program usually contain background materials which make the selection of molecular ions in mass spectra difficult or impossible. Formation of trimethylsilyl derivatives and use of combined GC-MS technique has assisted in the solution of these problems. The system has been of further use in unambiguous identification of GC peaks in analysis of tobacco smoke components. Comparison of retention volumes or times is often of questionable value in GC peak identification, but the mass spectrum of the effluent usually makes the identification absolute. Author

N72-19525# Institut d'Astrophysique, Liege (Belgium).
A SPECTROGRAPH FOR ROUTINE AURORAL OBSERVATIONS FROM THE GROUND [SPECTROGRAPHE AURORAL DESTINE A DES OBSERVATIONS DE ROUTINE A PARTIR DU SOL]
J.-M. Vreux, G. Marette, F. Montfort, and B. Lewandowski Paris ESRO Dec. 1971 20 p refs In FRENCH; ENGLISH summary Sponsored by ESRO
(ESRO-SM-82) Avail: NTIS

A ground-based observation station was developed from a rocket spectrograph (C-52 payload) for recording the auroral spectra at Kiruna (Sweden), the observation of artificial cloud spectra, and for the observation of low latitude auroras. The main differences between rocket and ground equipment are described, as well as the electronics for automatic recording. Some auxiliary devices are also reviewed. ESRO

N72-19526# Compagnie Francaise Thomson-Houston, Paris (France). Lab. Central de Recherches.
LASER INTERFEROMETRY IN A CONTROLLED ENVIRONMENT Final Report [INTERFEROMETRIE LASER EN AMBIANCE CONTROLEE RAPPORT FINAL]
M. Lacombat 17 Jul. 1970 52 p In FRENCH
(LCR-70-101/1/R) Avail: NTIS

The lack of precision in the determination of the parameters of the ambient air in interferometric dimensional measurements limits the accuracy of these measurements. A new method was tested involving the separation of the interferometer from its environment while the accessibility to the measured object was maintained. This method can only be used when the deformation and stresses due to vacuum are small with respect to the measurements. An evaluation of accuracy and stability of the equipment showed that it can provide measurements with an accuracy of up to two tenths of a micron. The device, which offers greater accuracy than conventional interferometers may find industrial application for rapid measurements of large gauges. ESRO

N72-19527# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
PHASE SHIFT AND VISIBILITY VARIATIONS CAUSED BY THE REFLECTION FROM THE SECOND SURFACE OF BEAM SPLITTERS IN TWO BEAM INTERFEROMETRY (MICHELSON)
G. H. C. Freeman Dec. 1971 40 p refs
(NPL-QU-19) Avail: NTIS

The beam incident on an interferometer can undergo several internal reflections in the beam splitter and compensator, and produce several emerging beams. The general properties of these beams are discussed and equations are derived for calculating their intensity and visibility from the reflection and transmission coefficients of the beam splitter. These satellite beams change the visibility and phase of the resultant interferogram and equations are given for calculating the maximum changes. The variations that are observed will depend on how the interferometer is used; if it is kept under very stable conditions the observed variations will be small and there will be little effect on wavelength shift work and line profile studies. However, even under these conditions the maximum variations still apply to measurements carried out over a large wavelength range, whether they are wavelength measurements or fourier transform spectroscopy. Author (ESRO)

N72-19528# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.
A PROGRAMMED RESPONSE, SPECTRAL-SCANNING PHOTOMETRIC SYSTEM
J. W. Dickey, D. J. Waltman, and George K. C. Hardesty Dec. 1971 52 p refs
(SF Proj. 013-01-01)
(AD-733982; NSDRL/A-6-135) Avail: NTIS CSCL 20/6

The report describes a new instrument to measure many photometric, radiometric, and colorimetric quantities. It has

particular application in the characterization of colored signals and visual displays because a single instrument can measure both the luminance and the chromaticity of an illuminated indicating device or display screen. It can also be made part of an inspection system or an industrial 'on-line' quality control process for dyed or painted products, alternately measuring tristimulus color values and total reflectance if desired. The instrument can also be programmed to process spectral information gathered from a target according to two (or more) different response functions. This would enable it to measure more complicated radiometric and photometric quantities such as cone-to-rod (dark adaptation) ratios. Author (GRA)

N72-19529# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
A GUIDE FOR THE PREPARATION OF SPECIFICATIONS FOR REAL TIME THERMAL IMAGING SYSTEMS
L. M. Biberman Jan. 1971 151 p refs
(Contract DAHC15-67-C-0011)
(AD-734385; P-676; IDA/HQ-70-11794) Avail: NTIS CSCL 17/5

The report discusses critical system parameters that affect combined observer system performance using real-time thermal imaging systems. The paper introduces the subject, defines the more important terms, discusses their measurement, makes recommendations, and finally presents an outline of procurement specifications to be completed by filling in appropriate spaces with numbers related to the requirements the forward-looking infrared (FLIR) is to fulfill. Author (GRA)

N72-19530# Michigan Univ., Ann Arbor. Dept. of Physics.
DEVELOPMENT OF OPTIMAL SYSTEM PROPERTIES FOR PULSED CINEHOLOMICROSCOPY Final Report, 1 Apr. 1969 - 31 Mar. 1971
Mary E. Cox 31 May 1971 33 p refs
(Contract N00014-67-A-0181-0025; NR Proj. 105-551)
(AD-734148) Avail: NTIS CSCL 14/5

The system parameters of importance in pulsed cineholomicroscopy have been identified and evaluated. The research has emphasized those parameters of relevance to the cineholomicroscopy system at the Naval Medical Research Institute. The influence of selected processing variables on holographic film parameters has been the central area of study. Film tests have been developed which are applicable in all holographic systems. Laser parameters which influence image quality have been identified and studied. Auxiliary studies on all aspects of the cineholomicroscopy project have been performed as needed. This report summarizes the results of this research.
Author (GRA)

N72-19531# ARO, Inc., Arnold Air Force Station, Tenn.
INVESTIGATION OF SHADOWGRAPHS FOR USE WITH HIGHLY ABLATING, SELF-LUMINOUS, BALLISTIC PROJECTILES Final Report
W. F. Henderson, G. W. Robertson, Jr., and J. W. Hill AEDC Dec. 1971 42 p refs
(Contract F0600-72-C-0003; ARO Proj. VG5111)
(AD-734742; AEDC-TR-71-225; ARO-VKF-TR-71-183) Avail: NTIS CSCL 14/5

Two modifications to the existing VKF 1000-ft Hyperballistic Range G spark shadowgraph system which reduce to an acceptable level the undesirable effects of highly ablating, self-luminous projectiles on the shadowgrams have been developed. In addition, an X-ray shadowgraph system is modified with a small lens, the system produces acceptable shadowgrams of moderately ablating projectiles. This modification is extremely economical. Author (GRA)

N72-19532# Naval Ship Engineering Center, Philadelphia, Pa.
TOWARD AN IMPROVED THERMAL RESPONSE TEST
Joseph T. Callahan and George D. Mott 6 Dec. 1971 40 p refs
(AD-735116; NAVSECPHILADIV-AP-557) Avail: NTIS CSCL 14/2

Heat transfer coefficients for cylinders of various geometries representing current thermometer bulb sizes were determined during MIL-STD-735A response time tests in different baths. Standard deviations were 9% and 10%. Standardizing bath geometry by the use of an immersion basket with fixed geometry and an integral stirrer was attempted without improvement for MIL-STD-735A response time tests. The standard deviation was 10%. Author (GRA)

N72-19533# Owens-Illinois, Inc., Toledo, Ohio.
THREE-COLOR PLASMA PANEL DISPLAY DEVICE Quarterly Report, 1 Apr. - 30 Jun. 1971
F. H. Brown, W. D. Petty, C. W. Salisbury, and M. Tamm Zayac Nov. 1971 46 p refs
(Contract DAAB07-70-C-0243)
(AD-734928; ECOM-0243-4; QR-4) Avail: NTIS CSCL 09/5

The objectives of this program are to design, fabricate, and evaluate a plasma-panel display device having a three-color capability and to investigate and develop a technique for operating such a device with at least three levels of intensity. Three-color DIGIVUE display/memory panels have been produced by the incorporation of selected photoluminescent phosphors into Xe-filled devices. Author (GRA)

N72-19534# TRW Systems Group, Redondo Beach, Calif.
RESEARCH AND DEVELOPMENT OF A PRESSURE TRANSDUCER FOR TEST CHAMBER MEASUREMENT Final Report, 1 Jul. 1969 - 30 Apr. 1971
Owen O. Fiet Arnold AF Station, Tenn. AEDC Dec. 1971 67 p refs
(Contract F40600-69-C-0009; AF Proj. 4344)
(AD-734763; AEDC-TR-71-144) Avail: NTIS CSCL 14/2

The report describes the initial design, construction and development of a diaphragm type pressure balancing transducer which uses the electromagnetic J x B force to balance the applied fluid pressure. The pressure is measured by the direct substitution of electromagnetic pressure and a measurement of the current required to produce the balancing pressure. This technique for pressure measurement results in a direct pressure measurement by substitution and is independent of the tension and elastic constants of the pressure sensing diaphragm provided positive tension is sustained in the diaphragm. Author (GRA)

N72-19535# Naval Research Lab., Washington, D.C.
A LOGARITHMIC PULSE GENERATOR Final Report
E. E. King 18 Oct. 1971 18 p ref
(NRL Proj. R08-42)
(AD-735109; NRL-MR-2373) Avail: NTIS CSCL 14/2

A pulse generator is described which produces several decades of pulses at intervals of 1, 2, 4, and 8. The user can choose the first and last decade of output. In the illustrated version, the first available pulse occurs at 100 microseconds after the generator is triggered, the last available pulse at 8 s. Pulses are typically 4 volts high and 2 microseconds wide. The circuit is implemented primarily with standard TTL (transistor-transistor logic) integrated circuits. Author (GRA)

N72-19536# Tyco Labs., Inc., Waltham, Mass.
HIGH TEMPERATURE INFRARED DETECTORS FOR AIRCRAFT FIRE DETECTION Final Report, 1 Jan. - 30 Sep. 1971
G. Entine, C. R. Mitchell, F. V. Wald, and F. H. Cocks Dec. 1971 95 p refs
(Contract F33615-71-C-1084; AF Proj. 3048)
(AD-734785; C-111; AFAPL-TR-71-89) Avail: NTIS CSCL 17/5

CdTe photodetectors capable of operating continuously at 750F were developed. The detectors at temperature could detect a photosignal of 100 micron W/square centimeters with a signal to noise ratio of fourteen to one with an output

impedance of 500 ohms. The detectors had peak sensitivity near 0.9 micron and were quite insensitive above 1.2 micron, making them ideal for operation as aircraft engine fire detectors.
Author (GRA)

N72-19537# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
PHOTOGRAPHIC EQUIPMENT Final Report
1 Dec. 1971 10 p refs
(AMCR Proj. 310-6)
(AD-734846; TOP-10-2-130) Avail: NTIS CSCL 14/5

The report provides guidance for the preparation of test plans to evaluate the operational and performance characteristics of photographic equipment; designates procedures for pre-operational inspection, operator training and familiarization, photographic coverage, physical characteristics, safety, performance tests for lens, cameras, and processing equipment, environmental testing, transportability, human factors evaluation, reliability, durability, maintenance evaluation and value analysis.
Author (GRA)

N72-19372# National Center for Atmospheric Research, Boulder, Colo.
SURVEY OF EXPERIMENTAL WORK IN HYDROMETEORS
J. Doyne Sartor *In its* Particulate Models: Their Validity and Appl. Aug. 1971 p 167-174 (See N72-19357 10-13)
Avail: NTIS

N72-19375# Meteorology Research, Inc., Altadena, Calif.
HYDROMETERS IN SUMMER CLOUDS
A. J. Alkezweeny *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 185-189 ref (See N72-19357 10-13)
Avail: NTIS

N72-19412# Laboratoire d'Electronique et de Physique Appliquees, Paris (France).
FUNDAMENTAL AND PRACTICAL LIMITS OF REMOTE INFRARED IMAGING INSTRUMENTS OPERATING BETWEEN 2, 5 AND 18 MICRONS
F. Desvignes *In* AGARD Propagation Limitations in Remote Sensing refs In FRENCH; ENGLISH summary (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

N72-19418# Army Engineer Topographic Labs., Fort Belvoir, Va.
THE USE OF COLOR AERIAL PHOTOGRAPH IN THE RECONNAISSANCE OF SOILS AND ROCKS
Abraham Anson *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-19538 University of Southern Calif., Los Angeles.
RELIABILITY DEMONSTRATION TEST PLANS FOR AEROSPACE SYSTEMS BASED ON BAYESIAN CONCEPTS Ph.D. Thesis
Thomas Mark Drnas 1970 2 p
Avail: Univ. Microfilms Order No. 70-23154

The objective of this study is to mathematically develop, analyze, select and document reliability demonstration plans based on Bayesian concepts. The proposed plans are analyzed to determine if and to what extent they are more efficient than classical sampling plans currently employed by the aerospace industry. The central problems in this research concern the method of selecting a prior distribution, relating the distribution to producer/consumer requirements and engineering judgment and the mathematical development of posterior distributions and fundamental inqualities from which Bayesian sampling plans may be generated. A number of prior distribution models are assumed and investigated with various modifications appealing to reliability engineers and aerospace project management. Dissert. Abstr.

N72-19539 National Lending Library for Science and Technology, Boston Spa (England).
STEEL/PLASTIC SANDWICH TECHNIQUE: A NEW METHOD OF CONSTRUCTION
O. Jungbluth 28 Dec. 1971 23 p Transl. into ENGLISH from Plastica (Schiedam), v. 23, 1970 p 606-619 In GERMAN and ENGLISH
(NLL-Trans-746-974-(9022.401); NLL-LTI-734-7669) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A survey is given on the technology of a sandwich construction of steel and polyurethane foam. Discussed are: Applications in building industry construction, physical aspects, economics, and production technology. Author

N72-19540 National Lending Library for Science and Technology, Boston Spa (England).
LUBRICANT PRESSURE AND EDGE DEFORMATIONS OF A ROLLER BEARING
Johannes Doerr [1954] 25 p Transl. into ENGLISH from Ing.-Arch. (West Berlin), v. 22, 1954 p 171-193
(NLL-M-22081-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The effects of lubricant pressure and edge deformations on the performance of roller bearings are discussed. The stresses in the lubricant as a function of the gap width and shape are examined. The numerical analysis is based on three assumptions as follows: (1) uniform deformation states are assumed in the roller elements, (2) the flow processes in the lubricant gap are assumed to be laminar and uniform, and (3) the viscosity of the lubricant is assumed to be independent of pressure and temperature. Equations of state and mathematical models are presented for various conditions. Author

N72-19541# Advisory Group for Aerospace Research and Development, Paris (France). Structures and Materials Panel.
APPLICATION OF NON-DESTRUCTIVE INSPECTION METHODS TO AIRCRAFT STRUCTURES
P. Gallinaro and R. B. Oliver Oct. 1971 34 p refs
(AGARD-R-587-71) Avail: NTIS

Nondestructive test methods are defined and their application for inspection of aircraft structures is evaluated, based on the results of an aircraft industry survey. For individual titles, see N72-19542 through N72-19543.

N72-19542# Advisory Group for Aerospace Research and Development, Paris (France).
NONDESTRUCTIVE INSPECTION OF STRUCTURES
P. Gallinaro *In its* Appl. of Nondestructive Inspection Methods to Aircraft Struct. Oct. 1971 p 3-14 refs (See N72-19541 10-15)
Avail: NTIS

Current methods of inspection are reviewed and their application is defined for three major areas: (1) inspection of adhesive bonded structures, (2) inspection of welded joints, and (3) inspection of riveted or bolted joints. D.L.G.

N72-19543# Advisory Group for Aerospace Research and Development, Paris (France).
SURVEY ON THE APPLICATION OF NONDESTRUCTIVE INSPECTION METHODS TO COMMERCIAL AIRCRAFT, 1968 TO 1970
Robert B. Oliver *In its* Appl. on Nondestructive Inspection Methods to Aircraft Struct. Oct. 1971 p 15-20 (See N72-19541 10-15)
Avail: NTIS

Data related to the application of nondestructive inspection methods were acquired from commercial airline overhaul bases, airframe manufacturers, research laboratories, and equipment manufacturers. The project was aimed at: (1) evaluating the current experiences in nondestructive inspection, (2) isolating the best nondestructive inspection procedures, and (3) making recommendations to improve the accuracy of the methods and to stimulate development of improved methods. The results of the project are presented in the form of a state-of-the-art review. D.L.G.

N72-19544*# Computer Sciences Corp., Huntsville, Ala. Field Services Div.
A SYSTEM RELIABILITY ANALYSIS FOR STAND-BY SPARES WITH NON-ZERO UNPOWERED FAILURE RATES
D. S. Taylor, J. E. Weatherbee, and T. Williams Dec. 1971 23 p refs
(Contract NAS8-21805)
(NASA-CR-61372) Avail: NTIS CSCL 14D

Equations which define the reliability of n-fold parallel systems with stand-by spares, and triply redundant, majority-voting systems with stand-by spares have been derived. The stand-by spares have been assumed to have a non-zero failure rate while in the stand-by mode. A Monte Carlo system simulation has been generated and the results compared to the theoretical reliability predictions. A comparison of these two stand-by configurations is also presented for three through six total units. Author

N72-19545*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF FACE DEFORMATION EFFECTS ON GAS FILM SEAL PERFORMANCE
John Zuk 1972 29 p refs Proposed for presentation at Ann. meeting of Am. Soc. of Lubrication Eng., Houston, Tex., 1-4 May 1972
(NASA-TM-X-68022; E-6828) Avail: NTIS CSCL 11A

Analyses are presented for compressible fluid flow across shaft face seals with face deformation. The solutions are obtained from an approximate integral analysis. The models, used in this analysis, can predict gas film seal behavior operating at subsonic or choked flow conditions. The flow regime can either be laminar or turbulent. Entrance losses can also be accounted for. When fluid inertia effects are negligible and the sealing faces are slightly deformed, the following results are found for both laminar and turbulent flows: (1) The pressure profiles are independent of fluid properties; and (2) the parallel film leakage equation can be used, provided a characteristic film thickness is used. Pressure profiles are presented for both divergent and convergent seal faces under choked flow conditions. Author

N72-19546# Technische Univ., Berlin (West Germany). Fakultaet fuer Maschinenwesen.
FATIGUE STRENGTH STUDIES ON AXLE-HUB ASSEMBLIES. NEWER AND OLDER STUDY RESULTS FROM INSTITUTE 1 FOR MACHINE ELEMENTS EXPOSED TO REVOLVING FATIGUE, ALTERNATING TORSION AND COMBINED LOADS IN CONNECTION WITH OTHER STUDY RESULTS Ph.D. Thesis [DAUERFESTIGKEITSUNTERSUCHUNGEN AN WELLEN-NABEN-VERBINDUNGEN. NEUERE UND AELTERE UNTERSUCHUNGSERGEBNISSE DES INSTITUTS 1 FUER MASCHINENELEMENTE BEI UMLAUFENDER BIEGUNG, WECHSELNDER VERDREHUNG UND KOMBINIERTER BEANSPRUCHUNG IM ZUSAMMENHANG MIT ANDEREN FORSCHUNGSERGEBNISSEN]
Raimar Seefluth 1970 199 p refs In GERMAN
Avail: NTIS

Fatigue life tests are reported on axle hub assemblies made with C35 that were exposed to rotational bending and alternating torsion loads. Obtained fatigue strength data are presented in diagrams according to residual strength values for the various loads, axle diameters, and connections for simplified selection and comparison by the user. Transl. by G.G.

N72-19547# Ampex Corp., Redwood City, Calif.
THE USE OF OPTICAL PROCESSING OF ENGINE VIBRATION DATA AS A MEANS OF PREDICTING FAILURES
B. V. Markevitch, D. R. Rodal, and H. L. Brown 1971 8 p refs Presented at 7th Ann. FAA Intern. Aviation Maintenance Symp., Oklahoma City, 7-9 Dec. 1971
Avail: NTIS

Optical spectral analysis has been shown to be capable of differentiating between good and bad ball bearings with specific frequencies, such as the ball spin frequency made quite visible. In some cases this frequency was observed to shift as the bearing wears and its dimensions changed. An example of the analysis of the vibration spectrum of a jet engine as picked up by an accelerometer on the engine casing is shown. Author

N72-19548*# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FABRICATION OF TITANIUM THERMAL PROTECTION SYSTEM PANELS BY THE NOR-Ti-BOND PROCESS Final Report
Robert R. Wells Oct. 1971 40 p refs
(Contract NAS8-26810)
(NASA-CR-123536; NOR-71-202) Avail: NTIS CSCL 13H

A method for fabricating titanium thermal protection system panels is described. The method has the potential for producing wide faying surface bonds to minimize temperature gradients and thermal stresses resulting during service at elevated temperatures. Results of nondestructive tests of the panels are presented. Concepts for improving the panel quality and for improved economy in production are discussed. Author

N72-19549*# Syracuse Univ., N.Y.
EFFECT OF METALLURGICAL STRUCTURE AND PROPERTIES ON ADHESION AND FRICTION BEHAVIOR OF COBALT ALLOYS
D. V. Keller, Jr., S. Shatynski, and P. M. Vedamanikam Washington NASA Mar. 1972 118 p refs
(Grant NGL-33-022-108)
(NASA-CR-1992) Avail: NTIS CSCL 11F

The metallurgical structure and some of the mechanical properties of two cobalt alloys, cobalt-50% iron and cobalt-25% molybdenum-10% chromium, were determined under various heat treated conditions. The mechanical properties of the bcc disordered Co-50Fe alloy, which was found to be very brittle, indicated an exceedingly low fracture strength, low hardness, and very weak grain boundary strength. Ordering by suitable heat treatment only produced a more brittle material with a lower fracture strength and a slightly higher hardness value. Work hardening was found to produce a finer grain structure and a greater grain boundary strength. Tensile properties were examined. It was found that the Co-25Mo-10Cr alloy was difficult to place in the alpha Co solid solution condition, which limited the ability to use precipitation as a hardening reaction. Over two hundred adhesion cycles from zero contact load, to maximum load, to fracture were conducted between couples for each of the above alloys in an ultrahigh vacuum system which would permit the sample surfaces to be cleaned of all contaminant layers. In the Co-50Fe case, the calculated fracture stress from the adhesion tests showed values in the range of 80 to 150 k.s.i., which is about ten times greater than the values from tension tests. Author

N72-19550# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION AND EXAMINATION OF CAST STEEL PARTS DESTINED TO GEAR MACHINING
L. X. Nepomucena, M. F. Barbosa, and J. A. Nepomuceno 7 Jan. 1972 8 p In PORTUGESE; ENGLISH summary
(TR-7201.556) Avail: NTIS

The equipment and procedures for ultrasonic inspection of cast steel to be used for machine gearing are described. The results are presented in schematics, and photos of the echograms showing the defects are included. Author

N72-19551# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
[ULTRASONIC INSPECTION OF WELDS FOR SUSPENSION BARS OF STAINLESS STEEL] [INSPECAO ULTRA-SONICA DAS SOLDAGENS EM BARRAS DE SUSPENSAO DE ACO INOXIDAVEL]
L. X. Nepomuceno, M. F. Barbosa, and M. T. Itami 10 Dec. 1971 8 p In PORTUGUESE; ENGLISH summary
(TR-7112.550/554) Avail: NTIS

The procedures and equipment used for ultrasonic inspection are described. The results are presented in schematics, and the echograms showing the defects are included. Author

N72-19552# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIFFUSION TITANIUM COATING OF REFRACTORY METALS
V. P. Shapovalov, N. S. Gorbunov, and R. K. Ognev 13 Sep. 1971 16 p refs Transl. into ENGLISH from "Zharostoikie Teplostoikie Pokrytiya" Leningrad, Izd-vo Nauka, 1969 p 132-139
(AF Proj. 7343)
(AD-733480; FTD-MT-24-126-71) Avail: NTIS CSCL 13/8

A method was developed for the noncontact thermal-diffusion titanium coating of refractory metals from the vapor phase in a vacuum. The possibility of titanium coating of refractory metals was shown - molybdenum, tantalum, and tungsten. The thicknesses of diffusion titanium coatings on refractory metals was established depending on the temperature and the time of holding. The fundamental possibility was shown for the control of the titanium coating of sheet refractory metals by the method of the determination of density by hydrostatic suspension.
Author (GRA)

N72-19553# North American Rockwell Corp., Seal Beach, Calif. Space Div.
A METHOD FOR EVALUATION AND SELECTION OF DEEP OCEAN LOAD HANDLING SYSTEMS, VOLUME 1 Final Report, 1 Jul. 1970 - 12 Feb. 1971
R. J. Knight, J. E. Curry, V. E. Bolding, J. C. Mitchell, and H. P. Weldon May 1971 404 p Revised Prepared in cooperation with Santa Fe Intern., Los Angeles, Calif.
(Contract N62399-70-C-0024)
(AD-730036; SD-71-293-1-Vol-1; NCEL-CR-71.009) Avail: NTIS CSCL 13/2

The study for the Development of a Method for the Evaluation and Selection of Deep Ocean Load Handling Systems was conducted to assist the U.S. Navy in performing seafloor construction projects through consideration of operations involving equipment and transport of materials for load implantment. The study has accomplished four primary tasks: (1) the assemblage and organization of data; (2) the development of a mathematical model which is descriptive of a generalized total deep ocean implantment mission; (3) translation of the data and model into a computerized method to enhance utilization; and (4) validation of the method through application of selected case examples. The method provides the capability to evaluate any selected deep ocean load handling system on the basis of critical mission parameters. This volume contains a synopsis of the study scope of the deep ocean load handling mission, analysis which was performed, and significant findings and general results of the study effort. A technical discussion is provided of the mathematical model inclusive of mechanization logic and evaluation factors. Formulation of the computer model defining format and utility subroutines is presented. Author (GRA)

N72-19554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MICROPLASMA ARC WELDING OF METALS AND ALLOYS
D. A. Dudka, V. S. Hyozdetskii, B. Y. Shnider, and M. M. Voropai 27 Sep. 1971 15 p Transl. into ENGLISH from Vizn. Akad. Nauk Ukr. RSR (Kiev), no. 8, 1969 p 69-75
(F33657-71-D-0057; AF Proj. 6010)
(AD-734054; FTD-HC-23-330-71) Avail: NTIS CSCL 13/8

The dc and ac arc low-current microplasma welding of metals and their alloys was studied to determine the effect of the consumption of the plasma-forming precathode gas and the anode protective (cooling) gas, the voltage, and the length of the microplasma torch on the quality of welding. GRA

N72-19555# Picatinny Arsenal, Dover, N.J. Techniques Div.
APTPLOT: A NUMERICAL CONTROL TAPE VERIFICATION PROGRAM
William D. Michaels Oct. 1971 75 p refs
(AD-734310; PA-TR-4270) Avail: NTIS CSCL 13/9

APTPLOT is a computer independent program written in the FORTRAN IV language. It verifies Numerical Control tapes produced by an APT Postprocessor by having the pen of a digital plotter reproduce the motions of the cutting tool. Author (GRA)

N72-19556# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FRICTION AND WEAR OF PLASTIC BEARINGS IN THE MACHINE ASSEMBLIES DURING CONDITIONS OF INADEQUATE LUBRICATION AND METHODS OF INCREASING THEIR EFFICIENCY
Yu. A. Evdokimoy 22 Sep. 1971 18 p refs Transl. into ENGLISH from Inzh. Mekhan. Polimerov i Primeneniye Plastmass v Prom. Materialy Resp. Soveshch. (Eng. Mech. of Polymers and the Ind. Use of Plastics. Mater. from the Rep. Conf., Tbilisi, Oct. 1967) Tbilisi, Izd. Metsniyereba, 1969 p 137-145
(AF Proj. 7343)
(AD-734222; FTD-MT-24-296-71) Avail: NTIS CSCL 13/9

The author considers the effects of friction, abrasion, metal contact, heat, and wear of kapron and textolite in comparing plastics as bearing materials with common bearing metals. Bearing metal couples are considered for improving bearing properties. GRA

N72-19557# Rocketdyne, Canoga Park, Calif.
CONTAMINANT PARTICLES IN METAL-TO-METAL CLOSURES Final Report, May 1970 - Jun. 1971
G. F. Tellier and T. R. Spring Edwards AFB, Calif. AFRPL Dec. 1971 196 p refs
(Contract F04611-70-C-0048)
(AD-734232; R-8782; AFRPL-TR-71-112) Avail: NTIS CSCL 13/11

The report contains the results of analytical and experimental investigations to develop metal-to-metal contaminant-resistant closures. Investigations were comprised of static and dynamic hit frequency and life cycle tests of hard-on-hard (440 C) and hard-on-soft (copper) closures with 1/2-inch nominal OD.
Author (GRA)

N72-19558# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS: METALS JOINING
R. M. Evans 26 Nov. 1971 6 p refs
(AD-734213) Avail: NTIS CSCL 13/8
Contents: aluminum; nickel; miscellaneous. GRA

N72-19559# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS: METALWORKING
F. W. Boulger and T. G. Byrer 24 Nov. 1971 6 p refs
(AD-734214) Avail: NTIS CSCL 13/8

Contents: High-velocity forging; Hydrostatic extrusion; Tube forming and bending; Sheet forming. GRA

N72-19560# Midwest Research Inst., Kansas City, Mo.
EXPERIMENTAL STABILITY STUDIES OF HYBRID HERRINGBONE-GROOVED GAS LUBRICATED JOURNAL BEARINGS Technical Report, Feb. 1970 - Jul. 1971
Ronald D. Dayton Nov. 1971 61 p refs
(Contract F33615-69-C-1265; AF Proj. 3048)
(AD-734240; AFAPL-TR-71-88) Avail: NTIS CSCL 13/9

The report presents the results of an experimental and, in some cases, analytical investigation into the stability characteristics of the herringbone-grooved rotor supported in self-acting and hybrid gas-lubricated journal bearings. The analytical investigation was accomplished using previously developed theory. Measurements of threshold of instability speeds (half-frequency whirl) were made for four different rotors. Two of the rotors were fully grooved and two were partially grooved. Variables investigated were bearing radial load, radial clearance, and bearing supply pressure. Also, the effects on stability of rotating the herringbone-groove geometry so as to be both inward pumping (toward the bearing center) and outward pumping (away from the bearing center) and of axially misaligning the groove geometry were investigated. Author (GRA)

N72-19561# Mechanical Technology, Inc., Latham, N.Y.
A BRIEF COMPARISON OF THE ACCURACY OF TIME DEPENDENT INTEGRATION SCHEMES FOR THE REYNOLDS EQUATION
Richard L. Coleman Sep. 1971 33 p refs
(Contract N00014-70-C-0135)
(AD-734410; MTI-71TR59) Avail: NTIS CSCL 13/9

Two dynamic methods are compared for integrating the Reynolds equation as applied to determining the axial dynamics of spool bearing. It is shown that very sensitive phase shifts in the numerical schemes can badly falsify the dynamics. Therefore, care is needed in interpreting results using classical methods. Second order temporal accuracy can alleviate these problems one such scheme is presented with excellent phase properties; that is just as computationally efficient per time step as any of the first order accurate schemes. Author (GRA)

N72-19562# Battelle Memorial Inst., Columbus, Ohio.
THIN FILM RHEOLOGY OF BOUNDARY LUBRICATING SURFACE FILMS, PART 2 Final Report, 21 Oct. 1970 - 20 Oct. 1971
E. Drauglis, K. C. Brog, N. F. Hartman, W. H. Jones, Jr., C. E. Moeller, and C. M. Allen Dec. 1971 26 p refs
(Contract N00019-71-C-0114)
(AD-734151) Avail: NTIS CSCL 11/8

The ultimate objective of the program is the attainment of a deeper understanding of the fundamental physics and chemistry of thin multimolecular films of organic liquids in contact with solid substrates and the application of this understanding to the solution of practical boundary lubrication problems. The report discusses the development of experimental techniques for the direct determination of the degree of order in films. Electron paramagnetic resonance (EPR) techniques and optical techniques were chosen for evaluation. EPR studies of films of a substance known to be ordered (nematic liquid crystal, MBBA) were performed with vanadium acetylacetonate as the paramagnetic probe. Author (GRA)

N72-19563# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRIBOLOGY CONSOLIDATES ITS POSITION
V. Dufek 26 Oct. 1971 17 p refs Transl. into ENGLISH from Strojirenstvi (Prague), v. 21, no. 1, 1971 p 55-59
(AF Proj. 7343)
(AD-734917; FTD-HC-23-1488-71) Avail: NTIS CSCL 11/8

The author outlines the field of tribology which is rapidly developing into a specific discipline covering essentially problems of friction, wear and lubrication. The article deals with the history of tribology, its development, principal targets of research works, bibliography, and results of recently held conferences. GRA

N72-19564# Army Chemical Center, Edgewood, Md.
AEROSOL FILTRATION BY FIBROUS FILTER MATS Technical Report, Jan. - Jul. 1971
Leonard A. Jonas, Carlye M. Lochboehler, and William S. Magee, Jr. Nov. 1971 31 p refs
(DA Proj. 1W6-62710-A-095)
(AD-734825; EA-TR-4574) Avail: NTIS CSCL 13/11

The purpose of the study was to determine the penetration characteristics of a 0.3-micron-diameter liquid dioctylphthalate (DOP) aerosol through four types of US Army mask filter mats as a function of variables, such as flow velocity, filter thickness, and pressure drop, and to develop in accord with present theory those mathematical relations which quantitatively express the experimental data. Author (GRA)

N72-19565# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF SURFACE ROUGHNESS FLOW THROUGH DUCTS ON THE HYDRAULIC EFFICIENCY OF CENTRIFUGAL PUMP STAGES
P. D. Lyapkov and Sh. R. Ageev 22 Oct. 1971 17 p refs Transl. into ENGLISH from Evergomashinostroenie (Moscow), no. 3, 1971 p 19-21
(AD-734861; FTD-MT-24-1459-71) Avail: NTIS CSCL 13/11

Three series of stages were used to investigate the influence of the surface roughness of flow-through ducts on the hydraulic efficiency of centrifugal pump stages. Each different series of stages is broken down in detail and methods for its manufacture are described. The experimental part consisted of conducting normal and balance stage tests on a laboratory stand. Descriptions of the tests and results are given. Author (GRA)

N72-19566# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
NRL BEARING LUBRICATION PROCESS DEVELOPMENT STUDY Final Report
John K. Sarkinen Dec. 1971 74 p
(Contract N00014-71-C-0241)
(AD-734622; Rept-21732-FR) Avail: NTIS CSCL 13/9

The report describes a program to develop a method of loading KG-80 lubricant into synthane phenolic retainers for gyro spinmotor ball bearing applications. The process and lubricant in conjunction with barrier antimigration film was evaluated for overall motor stability and life capability. The test program is part of an overall NRL objective to develop a lubricant system which can support the needs of the inertial components industry. Author (GRA)

N72-19567# Battelle Memorial Inst., Columbus, Ohio.
METALLOGRAPHY OF VACUUM-BRAZED, VACUUM HEAT-TREATED, GAS-QUENCHED MATERIALS Final Report
James L. McCall Nov. 1971 76 p refs
(DAAA15-69-C-0701; DA Proj. 4932-10-51129)
(AD-734923) Avail: NTIS CSCL 13/8

All of the materials studied were found to have comparable properties and microstructures when conventionally heat treated and quenched and when heat treated in vacuum and quenched by gas. In fact, in some materials, improved properties were attained by the gas-quenching process. Brazed joints of good quality were achieved by the process in all the materials studied

except the 2014 aluminum, for which no suitable brazing alloy with low enough melting point is available, the 2219 aluminum in which incipient melting of grain boundaries occurred, and the 18Ni250 steel in which brazed joints with good flow and filleting were achieved but in which quite a bit of porosity was present. The results indicate that the vacuum-brazing, vacuum-heating, and gas-quenching process holds promise as a reliable method of joining certain materials. Author (GRA)

N72-19568# Naval Undersea Research and Development Center, San Diego, Calif.
CURV LINKAGE MANIPULATOR Research and Development Report, Jan. - Dec. 1970
R. Uhrich Nov. 1971 14 p
(UF Proj. 17-383-202)
(AD-735122; NUC-TP-271) Avail: NTIS CSCL 13/8

A spot-mounted, variable, rate-controlled hydraulic manipulator was developed for the cable-controlled undersea research vehicles, CURV 2 and CURV 3. This manipulator incorporates a mechanical linkage arm which provides linear hand extension and eliminates disorienting cross-coupling of functions. The wrist is extremely compact, and is designed to further minimize cross-coupling. The hand is a synchronized, paralled jaw linkage. This combination of mechanical features is desirable from the standpoint of human factors. Control signals are encoded in binary, and are sent to a pressure-balanced, hydraulic-flow control package. This unit decodes the signals, and energizes hydraulic valves which control the magnitude and direction of flow to the appropriate actuators. The overall system is well adapted for operation in the corrosive and high-pressure undersea environment. Author (GRA)

N72-19569# Naval Civil Engineering Lab., Port Hueneme, Calif.
MEMO: A NEW CONCEPT IN SUBMERSIBLES Final Technical Report, Jul. 1968 - Sep. 1970
P. K. Rockwell, R. E. Elliott, and M. R. Snoey Nov. 1971 86 p
(AD-735103; NCEL-TR-749) Avail: NTIS CSCL 13/10

Experimental and analytical studies, conducted to evaluate continental shelf depth performance of a spherical acrylic plastic hull, have led to the design and construction of NEMO (Naval Experimental Manned Observatory). NEMO consists of an acrylic plastic pressure hull with a 61-inch inside diameter and a 66-inch outside diameter, plus life support and operational subsystems. The life support system, which consists of an oxygen supply, CO2 scrubber, closed-circuit emergency rebreathers, and atmosphere monitoring equipment, provides 8 hours of life support, plus an additional 24 hours emergency backup for two men. Author (GRA)

N72-19488# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Satellitenelektronik.
SOME NOVEL METHODS IN FAILURE ANALYSIS
E. Ress and G. Ress *In* AGARD Avionics in Spacecraft Sep. 1971 12 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-19570*# United Aircraft Corp., East Hartford, Conn.
RESEARCH AND INVESTIGATION OF GAS DYNAMIC LASERS Final Report
L. R. Boedeker and B. R. Bronfin 10 Nov. 1971 66 p refs
(Contract NASw-2181)
(NASA-CR-125806; UARL-K911106-4) Avail: NTIS CSCL 20E

Chemical mixing laser investigations were conducted (1) to investigate the properties of a bimolecular exchange laser system pumped by the H + Cl2 yields HCl(v) + Cl reaction, initiated by arc-dissociated H2, with lasing occurring between wavelengths of 3.4 and 4.0 microns, and (2) to establish the feasibility of an atom recombination-transfer laser employing recombination of arc-dissociated nitrogen with subsequent transfer of vibrational energy to CO2 for lasing at 10.6 microns. One-dimensional analytical results indicate higher results should be obtained with up to v = 3 to 2 transitions participating. Diagnostic and analytical results show that the reaction mechanism during mixing, a back reaction of HCl(v) with H atoms, reaction of Cl with H2(v), moderately fast V-V, V-T processes, and possible HCl(o) initial contaminant level may explain the low performance. N2-CO2 thermal mixing laser studies were extended to measure the efficiency of transfer of recombination energy in such a nonequilibrium N2 source to 10.6 microns optical energy. The low level of efficiency suggests that V-T decay processes may prevent vibrational energy freezing until much lower temperatures are achieved and that trapping of energy in long-lived electronic excitation of N2 may be a factor. Author

N72-19571# Bureau of Mines, Denver, Colo. Mining Research Center.
AN EXPERIMENT IN SEISMIC HOLOGRAPHY
G. L. Fitzpatrick, H. R. Nicholls, and R. D. Munson 1972 23 p refs
(BM-RI-7607) Avail: NTIS

Preliminary results of an experiment in seismic holography indicate that the techniques of acoustical holography may be successfully used with seismic waves to determine the size and general shape of underground objects. This experiment was carried out under field conditions on a moderately large scale compared with the typical laboratory experiments in acoustical holography. The object to be mapped was a 100-foot-diameter, spherical, low-velocity zone of explosively fractured rock in oil shale at an average depth of 80 feet. The seismic wavelength of the Fourier component wave used in making the seismic holograms was 50 feet at a frequency of 140 cps. The hologram sampling aperture was 226 feet square and was sampled by 441 geophones in a 21 by 21 rectangular array. A successful laser reconstruction of the object image from a lensless Fourier-transform hologram in the form of a 5/16-inch-square photographic transparency is illustrated. The size of the underground object measured from the laser reconstruction of the object and the size inferred from a knowledge of the amount of explosives used to fracture the site and the tensile strength of the oil shale are found to agree. Author

N72-19572*# Scientific Translation Service, Santa Barbara, Calif.
USE OF MOLECULAR ELECTRON-VIBRATIONAL PHOTOTRANSITIONS IN LASERS WITH THERMAL PUMPING
V. O. Kochelap Washington NASA Mar. 1972 12 p refs
Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 3, Mar. 1971 p 394-400
(Contract NASw-2035)
(NASA-TT-F-14159) Avail: NTIS CSCL 20E

Laser designs with thermal pumping are discussed in which the working body is a molecular gas in which the electron states require more time to reach equilibrium than the vibrational levels. For diatomic gas molecules, the probability of phototransitions between electron states is obtained, the cooling rates required for obtaining a population inversion are estimated, and the laser action threshold is determined. The results are applied to Cl2, Br2, BrCl and to some other diatomic halide gases. Chlorine concentration requirements are given for obtaining a satisfactory laser action threshold when the chlorine gas is cooled down to 3500 K in a 60 cm resonator having a mirror reflection coefficient of 0.05. Author

N72-19573# European Space Research Inst., Frascati (Italy).
TUNABLE, SPECTRALLY BRIGHT NEAR UV EMISSION BY THE SECOND HARMONIC OF A DYE LASER

S. M. Hamadani and G. Magyar [1971] 11 p refs Submitted for publication
Avail: NTIS

A tunable near UV laser with high spectral brightness has been constructed. A ruby giant pulse laser pumps a polymethene dye. The resulting IR emission is tuned and narrowed with two tilted Fabry-Perot interferometers and a resonant reflector. This beam then generates second harmonic light in ADP or LiIO crystals, in various configurations. Best result obtained from LiIO externally: 16 mJ in a width of USS or approximately equal to 0.005 nm. Author (ESRO)

N72-19574# Naval Weapons Center, China Lake, Calif.
HIGH-POWERED PULSED LASER DESIGN USING A SEGMENTED RUBY OSCILLATOR
Gary Kvammen Sep. 1971 32 p refs
(AD-733072; NWC-TP-5254) Avail: NTIS CSCL 20/5

A weatherproof high-power ruby laser suitable for use on range tracking mounts was designed and fabricated using a water-cooled segmented ruby oscillator (also variously referred to as a disk, zig-zag, slab, or axial gradient oscillator). A solid ruby rod (long cylinder) was not used as radial temperature gradients occurring within solid rods limit the pulse repetition rate to 1 pulse/second. Design goals for the laser were 30 megawatts peak power output at 10 pulses/second. Test results showed the maximum repetition rate was only 2 pulses/second, but this was attributed to an insufficient coolant flow through the segmented ruby oscillator. This report, which describes the laser, its various components, and its operation, also cites criteria for the design of an optimum unit. Author (GRA)

N72-19575# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THREE RESEARCH NOTES ON LASERS AND OPTICAL SPECTROSCOPY Technical Report, Jun. 1967 - May 1971
Milton Birnbaum, Curtis L. Fincher, Jerry A. Gelbwachs, Paul Kisliuk, Tom L. Stocker, Armin W. Tucker, Paul H. Wendzikowski, and Wilfred S. Otaguro 1 Jul. 1971 27 p refs
(Contract F04701-71-C-0172)
(AD-731553; TR-0172(9230-10)-1; SAMSO-TR-71-227) Avail: NTIS CSCL 20/5

Contents: Continuous-wave nonspiking single-mode ruby lasers; Linewidths of the R prime optical transitions of chromium ions in ruby; New oil laser line (6640 A). GRA

N72-19576# Texas Univ., Austin. Electronics Research Center.
THE SCATTERING FROM ROUGH CURVED SURFACES OF A WAVE PROPAGATED THROUGH A RANDOM MEDIUM
Darryl P. Greenwood and E. J. Powers, Jr. 1 Jun. 1971 90 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-734044; TR-104; AFOSR-71-1988TR) Avail: NTIS CSCL 17/5

A generalized investigation of wave scattering from rough surfaces yields an expression for mean scattered power flux which is the spatial Fourier transform of the product of three transfer functions: The optical transfer function (OTF) of the propagating medium; The joint characteristic function of the surface roughness; A coherence involving the mean surface and the wave profile. The results are applicable to rough surfaces which do not have rms slopes greater than a few degrees. The solution is applied to laser scattering from aluminum and titanium airplane surfaces where the medium is the clear atmosphere. Proficorder tracing of sample rough surfaces reveals independent roughness and waviness components normally distributed with Gaussian (isotropic) autocorrelation.
Author (GRA)

N72-19577# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
SATURABLE ABSORBING MATERIALS FOR Q-SWITCHING NEODYMIUM LASERS Semiannual Report, 1 Feb. - 1 Sep. 1971
Hai-Men Lo Dec. 1971 46 p refs
(Contract DAAB07-71-C-0122; DA Proj. 1H6-62705-A-056)
(AD-733879; ECOM-0122-s) Avail: NTIS CSCL 20/5

The report describes investigative work performed on IBM proprietary dye 106-5 for Q-switching neodymium lasers carried out under contract No. DAAB01-71-C-0122. This dye was used in solution form to Q-switch a neodymium glass laser to deliver a peak power of over 100 megawatts in approximately 20 nanoseconds and in plastic thin film form to Q-switch a flashlamp pumped neodymium-yttrium aluminum garnet (YAG) laser to deliver a peak power of over 3 megawatts with a 15 nanoseconds pulse width. The selection of solvents and solid host materials for this dye as well as the construction of the liquid dye cell and the supported plastic-dye film are discussed. Results on durability and reliability tests done on the Q-switch solution before are also included. Based on the present results, design recommendations are made for improving the performance of the Q-switch dye in a solution form as well as in a solid matrix. Author (GRA)

N72-19578# Purdue Research Foundation, Lafayette, Ind.
STUDY OF POTENTIAL APPLICATION OF HOLOGRAPHIC TECHNIQUES TO MAPPING Final Technical Report, Oct. 1970 - Sep. 1971
Maurice K. Kurtz, Jr., N. Balasubramanian, Edward M. Mikhail, and Warren H. Stevenson Oct. 1971 273 p refs
(Contract DAAK02-69-C-0563; DA Proj. 4A0-61102-B-52-C)
(AD-734327; ETL-CR-71-17) Avail: NTIS CSCL 08/2

The potential uses of optical holography in photogrammetric mapping are identified. Techniques are given for presenting information which has been quantitatively extracted by mapping holographic virtual images of realistic objects and terrain. During measurement, with a self-illuminated measuring mark, it was found that the position accuracy varies inversely with magnification and directly as the square of the viewing distance to the image. By modifying the Wild A7 Autograph so that the holographic virtual image could be absolutely oriented it was possible to map the image both digitally and by plotting detailed outlines, planimetry, profiles and contours. It is believed that the first topographic maps ever made from holographic images were produced. Author (GRA)

N72-19579# Raytheon Co., Waltham, Mass. Research Div.
INFRARED LASER MATERIALS Research and Development Interim Technical Report, 15 Mar. - 15 Sep. 1971
Andrew D. Morrison, Roch R. Monchamp, Michael Bass, and Marvin J. Weber Ft. Monmouth, N. J. ECOM Nov. 1971 44 p refs
(Contract DAAB07-71-C-0150; DA Proj. 1H6-62705-A-056)
(AD-734318; S-1353; ECOM-0150-1) Avail: NTIS CSCL 20/5

Neodymium-doped yttrium orthoaluminate is investigated for use as a high-efficiency optically-pumped infrared laser material. The growth of high optical quality crystals was studied and growth parameters including pull and rotation rates, atmosphere, thermal ambients, and annealing are discussed. Measurements of hardness and the distribution coefficient of Nd3- in YAlO3 and the presence of scattering sites and the tube effect are described. Several possible sensitizer ions for Nd3- are considered and the optical spectra of cerium and vanadium in YAlO3 are reported. Laser rods containing 1 percent and 3.2 percent Nd were prepared and tested in long-pulse and cw laser operation. The results from these b-axis Nd:YAlO3 rods are compared with those obtained from Nd:YAG. Author (GRA)

N72-19580# Cornell Univ., Ithaca, N.Y.
STUDY OF MOLECULAR LASERS Annual report
Peter L. Auer and George J. Wolga 1 Nov. 1971 107 p refs
(Contract N00014-67-A-0077-0006; ARPA Order 660)
(AD-734170) Avail: NTIS CSCL 20/5

The report presents results from research on molecular and

chemical lasers. The topics include: Vibrational deexcitation and energy transfer in the HF, CF, HF-CO2 and DF-CO2 chemical lasers; Shock tube studies of vibrational relaxation in CO2 induced by collisions; Efficient atom production by molecular dissociation in a high power S-band microwave discharge; Chemical laser studies with C2H2 - O, CS2 O; Chemical reaction rates for H - Cl2 to HCl - Cl, H F2 to HF - F, NO - F2 to NOF - F; Study of rapid gas mixing in a subsonic gas flow enhanced by controlled turbulence; High pressure vibrational relaxation studies in CO2. GRA

N72-19581# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
INVESTIGATION OF HOLOGRAPHIC TESTING TECHNIQUES Final Report, 27 Nov. 1968 - 28 Jul. 1971
C. M. Vest, E. N. Leith, W. R. Ribbens, D. W. Sweeney, and J. R. Varner Dec. 1971 148 p refs
(Contract DAAG46-69-C-0017; ARPA Order 1245)
(AD-734408; Rept-24200-28-F) Avail: NTIS CSCL 14/2

The final technical report on holographic testing research includes a number of specific investigations conducted at the Radar and Optics Division of Willow Run Laboratories and at Cooley Electronics Laboratory of The University of Michigan. The investigations described include the following: (1) interferometric detection of microcracks; (2) detection of debonds in honeycomb sandwich structures, (3) real-time monitoring of stress-corrosion cracking, (4) interferometry of three-dimensional, refractive-index fields, (5) measurement of vibrational amplitudes, (6) holographic contouring, (7) optical determination of rms surface roughness, and (8) non-destructive inspection of shell casings and projectiles. The report also includes a brief introductory section on holography and holographic interferometry and a brief glossary of technical terms for the benefit of readers who are not acquainted with this technique. Author (GRA)

N72-19582# Utah Univ., Salt Lake City.
MICROWAVE DEVICE AND PHYSICAL ELECTRONICS LABORATORY Quarterly Report, 1 Oct. - 31 Dec. 1970
L. P. Anderson, R. L. Arnold, and J. M. Baird 31 Dec. 1970 76 p refs
(Contracts F44620-68-C-0022; N00014-69-C-0345; AF Proj. 7921-02)
(AD-734439; MDL-Q35; UTEC-MP-71-143; AFOSR-71-3009TR) Avail: NTIS CSCL 20/5

The broad purpose of the research activity reported is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. At present this objective is being pursued by studies of electron beam devices, quantum electronic devices, plasmas, and solid-state devices. Author (GRA)

N72-19583# Northrop Corp., Hawthorne, Calif. Laser Systems Dept.
CO LASER LINE SELECTION TECHNIQUE Technical Report, 1 Aug. 1970 - 15 Dec. 1971
Mani L. Bhaumik Dec. 1971 39 p refs
(Contracts N00014-71-C-0037; N00014-72-C-0043; NR Proj. 016-303)
(AD-734417; NLSD-71-7R) Avail: NTIS CSCL 20/5

An intracavity gas cell technique is demonstrated for restricting the carbon monoxide (CO) laser oscillations to lines coincident with the transmission bands of the atmosphere. Using an intracavity water vapor cell, the CO laser gain was spoiled in lines that are absorbed by atmospheric water vapor, permitting the oscillations to build up only on the higher transmission lines. Author (GRA)

N72-19584# Radio Corp. of America, Princeton, N.J.
EFFECTS OF TURBULENCE INSTABILITIES ON LASER PROPAGATION Quarterly Progress Report, 9 Jun. - 8 Sep. 1971
David A. deWolf Griffiss AFB, N. Y. RADC 8 Oct. 1971 27 p refs
(Contract F30602-71-C-0356; ARPA Order 1279)
(AD-734798; PRRL-71-CR-31; RADC-TR-71-249; QPR-1) Avail: NTIS CSCL 20/6

When images are formed from laser beams propagating through turbulent air, a variety of scintillation phenomena occurs: beam wander, intensity fluctuations, hot- and cold-spot formation, image blurring, spot broadening, etc. The purpose of this project is to study these effects analytically, and thus to interpret measurements and predict performance in future laser systems. Author (GRA)

N72-19585# General Electric Co., Schenectady, N.Y.
YTTRALOX CERAMIC LAYERS Annual Report, 1 Jun. 1970 - 31 May 1971
C. D. Greskovich and K. N. Woods 31 May 1971 51 p refs
(Contract N00014-70-C-0360; ARPA Order 1587)
(AD-734936; S-71-1085) Avail: NTIS CSCL 20/5

The long range goal of the current program is to develop the necessary technology for reproducibly fabricating a laser host material with both high peak and high average power characteristics. During the first year's contract, the overall goal was to evaluate Yttralox (90% Y (2)O (3), 10% ThO(2) or ZrO (2) in solid solution) ceramic for these characteristics. The major efforts of the first year's contract were to (1) seek to understand the sintering process with respect to the kinetics of porosity change, (2) develop a process to reproductibility fabricate Yttralox of improved optical quality, (3) evaluate Yttralase as a potential laser material by means of optical measurements, and (4) fabricate five laser rods of the best quality possible for delivery to the sponsor. GRA

N72-19586# Pennsylvania State Univ., University Park. Center for Air Environment Studies.
A STUDY OF THE EFFECTS OF AEROSOL PROPERTIES ON SCATTERING OF LASER LIGHT
R. Lee Byers, Douglas W. Cooper, and John W. Davis 1 Jul. 1971 145 p refs
(Contract CPA-70-130)
(PB-204356; APTD-0796) Avail: NTIS CSCL 17H

The influence of several variables on the backscattering of laser light by aerosols was studied. HeNe laser light was used to illuminate aerosol particles generated by a Collison atomizer. The backscattering of light by the particles (effective angle: 173.5) was measured as a function of relative humidity. Depolarization and field studies were also made. Potassium chloride, sodium chloride, and sodium bromide particles all scattered more than twice as much light after becoming droplets. The change in phase occurred at lower humidities than those appropriate for the bulk material. These salt particles depolarized 13 to 25% of the incident polarized light intensity when dry particles and 6 to 12% of the incident light when droplets. The effect of changing ambient relative humidity was also studied for methylene blue dye and uranine dye particles. Depolarization measurements were also made for polystyrene latex and dioctyl phthalate aerosols. These gave depolarizations of 6% and 4% respectively. The laboratory device which measured the backscattering from the aerosols was used in a field test along with a LIDAR device. The field test, while not conclusive, indicated that relative humidity did affect LIDAR measurements. Author (GRA)

N72-19587# Naval Ordnance Lab., White Oak, Md.
A LASER OPTICAL LEVER SYSTEM FOR MEASURING THE PITCH AND YAW OF A GROUND LAUNCHED ROCKET
Carl M. Franz 1 Oct. 1971 22 p refs
(AD-735106; NOLTR-71-112) Avail: NTIS CSCL 20/6

The report describes a photo-optical system that has been designed for measuring the pitch and yaw of ground launched rockets during their first twenty feet of flight. The precision of test attitude measurements from the system was within three minutes of arc. The system was based on a one hundred foot

optical lever arm consisting of a stationary CW Argon Laser with beam diverging optics, a concave first-surface mirror mounted on the nose of the rocket, and a large reflecting screen. The laser and the screen were each located approximately seven degrees off the rocket flight line. Author (GRA)

N72-19588# Ohio State Univ., Columbus. Electroscience Lab.
INVESTIGATION OF LASER PROPAGATION PHENOMENA Interim Technical Report, 1 Jan. - 1 Jul. 1971
Stuart A. Collins, Jr. and G. W. Reinhardt Aug. 1971 52 p refs
(Contract F30602-71-C-0132; ARPA Order 1279)
(AD-734547; ESL-3163-2; RADC-TR-71-248) Avail: NTIS CSCL 20/6

This report deals with theoretical investigations in the area of linear atmospheric propagation phenomena and microturbulence statistics. It specifically deals with the examination of proper averaging times required for propagation experiments and with theoretical backup for phase structure function measurements. Finally, a bibliography on optical propagation which was prepared earlier has been updated. Author (GRA)

N72-19513# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AUTOMATIC TRACKING OF Q-SWITCHED LASER RANGEFINDERS
Roland Moreau *In* AGARD Avionics in Spacecraft Sep. 1971 12 p refs In FRENCH; ENGLISH summary (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19416# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ERBIUM LASER PROPAGATION IN A CO2 ATMOSPHERE IN THE NEAR INFRARED
Kenneth O. White, E. Howard Holt, Stuart A. Schuleusener (New Mexico State Univ., Las Cruces), and Robert F. Calfee (NOAA, Boulder, Colo.) *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 5 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-19589 National Lending Library for Science and Technology, Boston Spa (England).
DEPENDENCE OF STABILITY OF INVAR GAMMA PHASE ON ALLOYING ADDITIONS
A. I. Zakharov, L. N. Fedotov et al 28 Dec. 1971 7 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (USSR), no. 4, 1971 p 60-61 In ENGLISH and RUSSIAN
(NLL-Trans-746-1110-(9022.401); NLL-LTI-737-12984) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of alloying elements (Cr, V, Nb, and C) on the resistance of the gamma phase of Invar towards transformation during the deformation process was investigated. The alloys were melted in an open induction furnace and poured into 60 kg ignots. The investigations were conducted using an X-ray diffractometer. Results are given in tabular form. Author

N72-19590 National Lending Library for Science and Technology, Boston Spa (England).
PRECIPITATION HARDENING OF HIGH TEMPERATURE Ni-Cr ALLOYS
M. Vystyd 28 Dec. 1971 16 p refs Transl. into ENGLISH from Kovove Mater. (Czechoslovakia), v. 8, no. 5, 1970 p 468-477 in ENGLISH and CZECH
(NLL-Trans-746-964-(9022.401); NLL-LTI-737-11880) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

It is concluded that the creep rupture strength of high temperature nickel-chromium alloys is caused by the precipitation hardening of these materials which form an equilibrium intermetallic phase of the Ni3Al type. The shape and size of the phase lattice corresponds precisely to the lattice shape and size of the solid solution, and the yield limit of the intermetallic phase increases with rising temperature. Author

N72-19591 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF ALLOYING ON THERMAL EXPANSION OF Fe-Ni ALLOYS WITH A THERMAL EXPANSION ANOMALY
N. A. Soloveva 28 Dec. 1971 12 p Transl. into ENGLISH from Sb. Tr. Tsentr. Nauchn-Issled Inst. Chernoi Met. (USSR), no. 54, 1968 p 77-84 In ENGLISH and RUSSIAN
(NLL-Trans-746-1116-(9022.401); NLL-LTI-737-3741) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect on the thermal expansion of a binary Fe-Ni alloy (31-33% Ni) of the following elements was investigated, % (according to weight): up to 13% W; up to 14% Mo; up to 6% Si; up to 8% V; up to 15% Cu; and up to 25% Co. Ternary Fe-Mo-Co alloys were also investigated. The elements for alloying were selected on the basis of the following considerations: W, Mo, and Si have low coefficients of expansion; W and Mo hardly increase during heating up to 500 C; and V and Co influence differently the Curie temperature of Fe-Ni alloys with V decreasing and Co increasing it. The differential dilatometric method and optical metallography were used. The magnetic saturation was supplementarily determined by the ballistic method, together with the Curie point and magnetizability during heating and cooling in the magnetometer. The alloys were melted in a high frequency induction furnace with magnesite crucible and were investigated in the forged state after annealing at 900 C. Author

N72-19592 National Lending Library for Science and Technology, Boston Spa (England).
FATIGUE BEHAVIOUR OF METALLIC MATERIALS IN A VACUUM AND VARIOUS GAS ENVIRONMENTS, PART 1 (II)
M. Boehmer et al 28 Dec. 1971 20 p refs Transl. into ENGLISH from Metallwiss. Technik (East Berlin), v. 24, 1970 p 857-863
(NLL-CE-Trans-5726-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The action of gases during the fatigue process are examined under the following headings: (1) possible mechanisms accounting for the action of gases, and of oxygen and water vapour in particular, on slipband formation, crack formation and crack propagation; (2) interaction between gases and metal surfaces; (3) possibility of a mono-molecular layer influencing crack formation and propagation; (4) calculation of time and pressure needed for the formation of a mono-molecular adsorption layer; (5) methods by which covering layers may accelerate the fatigue process by influencing the slip potential and the defect structure below the oxide layer; (6)welding of crack surfaces; (7) formation of load-carrying oxide bridge; (8) pentration of gases into interior of the material; and (9) lowering of surface energy. Author

N72-19593*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE EFFECTS OF SOLUTION TREATMENT ON THE MECHANICAL PROPERTIES OF AGE-HARDENED A-286 BAR STOCK AT ELEVATED AND CRYOGENIC TEMPERATURE

J. W. Montano 16 Feb. 1972 30 p refs
(NASA-TM-X-64638) Avail: NTIS CSCL 11F

The mechanical properties are presented of solution treated and age hardened A-286 corrosion resistant steel bar stock. Material solution treated at 899 C or 982 C, each followed by an age hardening treatment of 718 C, was evaluated. Test specimens manufactured from 1.50 inch (3.81 cm) diameter bar stock were tested at temperatures from +649 C to -253 C. The test data indicated excellent tensile, yield, elongation and reduction-in-area properties at all testing temperatures for both solution treated and aged materials. Cryogenic temperature notched tensile, impact, and shear tests indicated excellent notch strength, ductility, and shear values. There was very little difference in the mechanical properties of the two solution treated and aged materials. The only exception was that the 962 C solution treated and aged material had superior stress rupture properties at 649 C. Author

N72-19594# Bureau of Mines, Boulder City, Nev. Metallurgy Research Lab.
RECOVERY OF ALUMINUM FROM ALUMINUM-SILICON ALLOYS
E. L. Singleton, R. L. deBeauchamp, and T. A. Sullivan 1972 15 p refs
(BM-RI-7603) Avail: NTIS

The extraction of aluminum from aluminum-silicon alloys as a means of utilizing domestic aluminum silicate ores for aluminum production was investigated. Aluminum was extracted from aluminum-silicon alloys by electrolysis in molten electrolytes of NaCl-KCl-AlCl3 and NaCl-KCl-AlF3 in a laboratory-scale cell. Six alloys with aluminum contents ranging from 20 to 87 percent aluminum were tested, and aluminum products of primary grade or better were obtained. More than 80 percent of the aluminum was recovered with current efficiencies as high as 91 percent. Recovery of a metallurgical-grade silicon product from the anode residue by an acid leaching procedure was possible with the 50-50 and 65-35 Al-Si alloys. Author

N72-19595*# Techtran Corp., Glen Burnie, Md.
ANALYTICAL BEHAVIOR OF TRACES OF CHROMIUM, PART 1
Klaus Beyermann Washington NASA Mar. 1972 39 p refs Transl. into ENGLISH from Z. Anal. Chem. (West Berlin), v. 190, no. 1, 1962 p 4-33
(Contract NASw-2037)
(NASA-TT-F-14143) Avail: NTIS CSCL 11F

Nanogram amounts of Cr were studied by using Cr-51. Means are described for preventing and accounting for loss of Cr during analysis and for oxidation of trace amounts of Cr. Separation of small amounts of Cr by various means and control of the separation operation are dealt with. This can be achieved by extraction with MIBR, or by acetylacetone with butylamine. Coprecipitation on hydroxide hydrates may be used for concentrating Cr from dilute solutions. Author

N72-19596# Joint Publications Research Service, Washington, D.C.
METALLURGY OF INDUSTRIAL NONFERROUS METALS AND ALLOYS
M. V. Maltsev 7 Mar. 1972 61 p Transl. into ENGLISH from the book "Metallografiya Promyshlennykh Tsvetnykh Metallov i Splavov" Moscow, Met. Publishing House, 13 Aug. 1970 p 3-6, 349-350 and 355-357
(JPRS-55357) Avail: NTIS

The technological processes used to process nickel, nickel alloys, titanium, and titanium alloys for industrial purposes are discussed. Efforts were made to establish the type of process according to the structure, composition, physical properties, and chemical properties of the materials. Extensive data tables and photographic illustrations are given. E.H.W.

N72-19597*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METALLIC TRANSFER BETWEEN METALS IN SLIDING CONTACT EXAMINED BY AUGER EMISSION SPECTROSCOPY
Stephen V. Pepper Washington Mar. 1972 16 p refs
(NASA-TN-D-6716; E-6649) Avail: NTIS CSCL 11F

Metallic transfer between polycrystalline metals in sliding contact was examined. Hemispherical riders of iron, nickel, and cobalt were slid on tungsten, tantalum, niobium, and molybdenum disks in ultrahigh vacuum. Auger emission spectroscopy was used to monitor the elemental composition of the disk surfaces. Iron, nickel, and cobalt transferred to tungsten, whereas only cobalt transferred to tantalum, niobium, and molybdenum. The results of this investigation are discussed in terms of the cohesive energy and strain hardening characteristics of the specimen materials. Author

N72-19598# Joint Publications Research Service, Arlington, Va.
PHYSICOCHEMICAL PHASE ANALYSIS METHODS FOR STEELS AND ALLOYS
N. F. Lashko, L. V. Zaslavskaya, W. N. Kozlova, G. I. Morozova, K. P. Sorokina, N. V. Khakhlova, and Ye. F. Yakovleva 7 Mar. 1972 98 p refs Transl. into ENGLISH from the book "Fiziko-Khimicheskiye Metody Fazovogo Analiza Staley i Splavov" Moscow, Metalurgiya Publishing House, 1970
(JPRS-55369) Avail: NTIS

The aspects of phase analysis and the research methods are presented for determining the characteristic features of alloy phases including crystalline structure, homogeneity, chemical affinity of the phase elements, and the number of phases. Phase analysis of iron-based alloys, and methods of phase analysis for nickel alloys are included. F.O.S.

N72-19599# Sandia Labs., Albuquerque, N.Mex.
FRACTURE THEORY FOR BRITTLE ANISOTROPIC MATERIALS
T. G. Priddy Nov. 1971 67 p refs
(SC-DR-71-0764) Avail: NTIS

A failure theory is developed by selectively using products of coordinate invariant quantities. A relatively simple equation results where interaction coefficients for tension-tension and compression-compression behavior may be defined separately. Additional approximations are included to reduce the required number of experimental data to nine for brittle three-dimensionally orthotropic materials. These are unidirectional tension and compression in three principal material directions and three pure shear strengths. A necessary condition that the theory closely describe brittle isotropic material strength is satisfied for a comprehensive set of cast iron biaxial data. Combined stress envelopes for example materials are illustrated. The theory encompasses several widely accepted yield and fracture theories such that the criterion may be used for general purpose stress state evaluations. Author

N72-19600# Lehigh Univ., Bethlehem, Pa. Dept. of Metallurgy and Materials Science.
EFFECT OF HEATING RATE ON THE MARTENSITE TO AUSTENITE TRANSFORMATION IN Fe-Ni-C ALLOYS
C. A. Apple and G. Krauss 31 Aug. 1971 107 p refs
(Contract AT(30-1)-3992)
(NYO-3992-4) Avail: NTIS

Martensite specimens of a series of Fe-Ni-C alloys with carbon contents of 0.004, 0.05, 0.3, and 0.6 wt pct were transformed to austenite at heating rates of 3 C/sec to 28,000 C/sec by resistance heating of wires. The temperatures at which the alpha prime to gamma transformation began and ended were determined from thermal arrests recorded during continuous heating and structures were examined by light and electron microscopy. Mechanical properties were determined on specimens heated at 3 C/sec and 1500 C/sec. The yield strengths of cycled austenites of all four alloys were increased compared to uncycled austenite. Although more austenite was retained in

cycled than in uncycled martensitic specimens, increases in yield strength of 10 to 16 ksi were obtained by cycling the three lower carbon alloys at 3 C/sec. Increasing the heating rate to 1500 C/sec resulted in an enhanced strengthening response only in the 0.05 and 0.3c alloys Author

N72-19601# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
SPIN-FLUCTUATION RESISTIVITY IN ALLOYS
Ryusuke Hasegawa Nov. 1971 9 p refs
(Contract AT(04-3)-822)
(CALT-822-39) Avail: NTIS

The decrease in resistivity of alloys with increasing temperature can be interpreted as a result of the resonance scattering due to resonance by spin fluctuations. Theoretical results yield reasonable values for the spin fluctuation temperature. Evidence is given for both low and high temperature spin fluctuation resistivities in some amorphous alloys. Author

N72-19602# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
STRESS CORROSION CRACKING OF Fe-Cr-Ni ALLOYS IN CAUSTIC ENVIRONMENTS Final Report, 15 Oct. 1970 - 30 Jun. 1971
A. K. Agrawal and R. W. Staehle 30 Jun. 1971 65 p refs
(Contract AT(11-1)-2018)
(COO-2018-24; QR-8; QR-9; QR-10) Avail: NTIS

Results from stress corrosion and electrochemical studies are reported for Fe-Cr-Ni alloys exposed to NaOH-H2O solutions and fused NaOH. A certain minimum stress, temperature, and caustic concentration is required for propagation of stress corrosion cracking in stainless steel 304. The rate of SCC is maximum at 70% yield stress. Stainless steel 304 in boiling 60% NaOH undergoes partial anodic protection between the potentials -750 and -100 mV sub H. Failure time in this range is considerably lower than at other potentials. The Fe-20Cr-Ni ternaries in 19.5N NaOH above -550 mV (SCE) corrode at a faster rate, due to high transpassive corrosion rate of Cr, than pure Fe or Fe-Ni binaries. Author

N72-19603# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
SOLID STATE PHYSICS PROGRAM. THE ELASTIC PROPERTIES OF COPPER AND COPPER-NICKEL ALLOYS Ph.D. Thesis
John R. Debesis Jan. 1971 121 p refs
(Contract AT(11-1)-623)
(COO-623-166; TR-70) Avail: NTIS

The ultrasonic pulse echo technique was used to measure the elastic constants and their pressure derivatives for copper and copper-nickel alloys at temperatures of 297 K, 195 K, and 77 K. Both the elastic constants' explicit temperature dependence at fixed volume and solute concentration and the elastic constants' pure solute concentration dependence at fixed volume and temperature were determined. From these results, it was concluded that the elastic constants of the alloys can be represented by the elastic constants of pure copper plus an additive term which is only a function of solute concentration.
Author

N72-19604# California Univ., Berkeley. Lawrence Radiation Lab.
ANALYSIS OF HIGH TEMPERATURE TRANSIENT CREEP OF PURE METALS AND ALLOYS Ph.D. Thesis
Kamal E. Amin Aug. 1971 29 p refs
(Contract W-7405-eng-48)
(LBL-163) Avail: NTIS

It is suggested that transient creep as high temperatures arises principally as a result of the dispersal of entanglements by the climb mechanism. The dispersal of the entanglements is assumed to follow a unimolecular reaction kinetics with a rate constant that depends on stress and temperature in the same way as does the secondary creep rate. The experimental creep data on several bcc and fcc metals and alloys correlate quite well with the proposed mechanism. The constants Beta and K were found to be independent of temperature and stress. The proposed formulation becomes inapplicable for correlating creep data in polycrystals at low stresses because of the significant contribution of grain-boundary sliding to the total creep at these stress levels. Author

N72-19605# National Aerospace Lab., Amsterdam (Netherlands).
A STUDY ON DUCTILE FRACTURE Ph.D. Thesis - Technol. Univ. Delft, Neth.
D. Broek [1971] 114 p refs
(NLR-TR-71021-U) Avail: NTIS

Electron microscopical examination of fracture surfaces and microstructure of thirteen different aluminum alloys revealed that ductile rupture is initiated at small inclusions. The average simple spacing is equal to the average inclusion distance. Void initiation is probably the critical event in ductile fracture; it is immediately followed by spontaneous growth and coalescence of the voids. A dislocation model is developed compatible with this point of view. Evaluation of this dislocation model yields a relation between the fracture strain and the volume fraction of the inclusions. The analysis also leads to a relation between the fracture toughness and the structural parameters.
Author (ESRO)

N72-19606# Army Materials and Mechanics Research Center, Watertown, Mass.
FIELD ION MICROSCOPE OBSERVATION OF IRON BASE TUNGSTEN ALLOYS
Robert D. French Aug. 1971 20 p refs
(DA Proj. 1T0-61102-B-32-A)
(AD-733937; AMMRC-TR-71-22) Avail: NTIS CSCL 11/6

A field ion microscope investigation was carried out for low-solute content iron base-tungsten alloys. These alloys had previously demonstrated an etching effect that was postulated to be the result of solute atom ordering. The investigation did not reveal ordering of the solute atoms, although a second etching effect was demonstrated. Specimen preparation for the field ion microscope produced a twin in one sample. The twin was analyzed for shape and boundary structure. Results are contrasted with earlier observations. Author (GRA)

N72-19607# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
EFFECT OF FLUID FLOW ON SOLIDIFICATION STRUCTURE
F. Schlecht, M. Rinaldi, and M. C. Flemings Jan. 1971 57 p refs
(Contract Nonr-3963(09))
(AD-734010; TR-4) Avail: NTIS CSCL 11/6

It is shown that the simple constitutional supercooling theory derived for a binary alloy can be applied to a ternary alloy when certain conditions are met. The conditions required to unidirectionally solidify a composite three-component crystal with a planar interface are a steep temperature gradient in the liquid at the interface and a low growth rate; when the ratio of these two variables is sufficiently high, a three-phase crystal with a eutectic like structure has been grown, even when the initial composition of the alloy was far from the eutectic composition. Alloys studied were of the Al-Cu-Ni system of different compositions on the line of two-fold saturation joining the ternary eutectic and the binary Al-NiAl3, and within the ternary tie-triangle. Author (GRA)

N72-19608# Carnegie-Mellon Univ., Pittsburgh, Pa.
THE EFFECT OF REVERTED AUSTENITE ON THE STRESS CORROSION CRACKING RESISTANCE OF TWO MARAGING STEELS
C. Jeanfils, Carlos A. Pampillo, and Harold W. Paxton 1 Nov. 1971 21 p refs

(Contract N00014-67-A-0314-0004)
(AD-734003) Avail: NTIS CSCL 11/6

The stress corrosion cracking susceptibility of two maraging steels (12 and 18 Ni) in a 3.5% NaCl aqueous solution was examined as a function of aging treatment. Comparisons are made of time and nominal stress to failure for three aging treatments giving for the 12-Ni composition a yield strength level of 160 ksi, and one of 180 ksi for the 18-Ni steel. The overaged condition was the most susceptible in both steels. The underaged specimens showed evidence of crack blunting; in terms of time to failure and threshold level, the higher temperature underaging treatment was found preferable. Author (GRA)

N72-19609# Watervliet Arsenal, N.Y.
FLASH HEATING: TECHNIQUE FOR OXIDATION STUDIES OF METALS
Joseph A. Walden and Fumihiko Saegusa Jul. 1971 33 p refs
(DA Proj. 1T0-62105-A-328)
(AD-734296; WVT-7137) Avail: NTIS CSCL 07/4

Flash heating utilizes the electromagnetic energy of a high-intensity light pulse for fusion and vaporization of metals. The resultant system can be analyzed photographically for investigation of kinetic and thermodynamic properties. Also, the system may be examined spectrophotometrically for elucidation of the gaseous products and their lifetime. A brief review of the previous studies has revealed that a variety of systems can be studied by the technique. The technique appears to be most promising in the study of corrosion of metals under conditions approximating those of the gun tube in its firing mode. A few experiments on rapid high temperature oxidation of metals are described. Author (GRA)

N72-19610# Watervliet Arsenal, N.Y.
CORRELATION OF MAGNETIC AND MECHANICAL PROPERTIES OF STEEL
Herbert Frankel Jul. 1971 24 p refs
(AD-734303; WVT-7147) Avail: NTIS CSCL 11/6

If a non-destructive test could be devised for measuring the mechanical properties of steel, the cost of making and breaking Charpy, tensile and fatigue bars could be saved. In addition, the mechanical properties could be determined for areas which are now practically impossible, such as along a gun tube where there is not enough surplus material to obtain these bars. This investigation shows a correlation between coercivity, a magnetic property of steel, and some of the mechanical properties. Unfortunately the departure from ideal, linear correlations prevents the immediate application of this process. Author (GRA)

N72-19611# International Harvester Co., Hinsdale, Ill. Manufacturing Services.
COMPUTERIZED SYSTEM FOR IMPROVED IMPACT TEST MATERIAL EVALUATION Final Report, Aug. 1968 - Sep. 1971
Clarence J. Carter and Raymond A. Cellitti Sep. 1971 150 p refs
(Contract DAAG46-69-C-0005)
(AD-734345; AMMRC-CR-71-16) Avail: NTIS CSCL 11/6

An automatic computerized impact test system for evaluating fracture toughness using Charpy specimens and analyzing load-time information is described and discussed. Author (GRA)

N72-19612# Army Materials and Mechanics Research Center, Watertown, Mass.
AUTOMATIC OFFSET-REFLECTION POLE FIGURE PLOTTER
Anthony G. Martin and Frank R. Larson Sep. 1971 12 p refs
(DA Proj. 1T0-62105-A-328)
(AD-734346; AMMRC-TR-71-33; DA-OB4769) Avail: NTIS CSCL 11/6

To facilitate the study of sheet metal textures, an automatic plotter has been developed and constructed for use with X-ray diffraction apparatus to produce pole figures of sheet specimens directly. The exposed plane may be either the rolling plane or a plane inclined to it at 54.7 degrees. The instrument provides plots of the intensity of diffracted X rays in terms of symbols representing eight levels on a stereographic projection referred to the rolling plane of a sheet. The data necessary to produce a quadrant of a pole figure are obtained and plotted in three hours. After completion of data plotting, contour lines are drawn manually between like symbols. Author (GRA)

N72-19613# Army Materials and Mechanics Research Center, Watertown, Mass.
DETERMINATION OF LOW COPPER IN STEELS AND IRONS BY ATOMIC ABSORPTION
Edna F. Jacobson Aug. 1971 20 p refs
(AD-731478; AMMRC-PTR-71-2) Avail: NTIS CSCL 11/6

An analytical method has been developed for the rapid determination of low copper (50 to 1800 parts per million) by atomic absorption. The method was successfully applied to different types of steels and irons, for example, low-alloy steel, stainless steel, tool steel, maraging steel, ingot iron, and cast iron. The detailed analytical method is appended to this technical report. Author (GRA)

N72-19614# Effects Technology, Inc., Santa Barbara, Calif.
TENSILE STRAIN AS A CRITERION FOR SPALLATION IN METALS Topical Report
Floyd R. Tuler 3 Aug. 1971 24 p refs
(Contract DASA01-68-C-0135)
(AD-734207; CR-71-36; DNA-2740T) Avail: NTIS CSCL 11/6

Spallation data has, for the most part, been obtained from plate impact experiments. Recently, spallation data for metals has become available using a high energy electron beam to generate stress waves by rapid uniform heating of the material. In this case the stress waves are produced by the expansion at the free surfaces of the specimen relieving the thermally induced high pressure. The crossing of the waves produces tensile stresses and strains near the center of the specimen that may result in mid-plane spall. The stress-strain response of the material is different for the uniform heating and plate impact cases. This difference is the critical information needed to show that spallation in metals is best described by a criterion based on strain rather than stress. Spallation results for three metals, 6061-T6 aluminum, OFHC copper and alpha titanium, are presented in terms of the critical strain necessary to produce incipient fracture. Author (GRA)

N72-19615# Dayton Univ. Research Inst., Ohio.
RESEARCH AND DEVELOPMENT OF RARE EARTH TRANSITION METAL ALLOYS AS PERMANENT MAGNET MATERIALS Semiannual Interim Technical Report, 1 Jan. - 30 Jun. 1971
Alden E. Ray and Karl J. Strnat Oct. 1971 132 p refs
(Contract F33615-70-C-1625; ARPA Order 1617; AF Proj. 7371)
(AD-734244; UDRI-TR-71-32) Avail: NTIS CSCL 09/1

Intermetallic phases R2(Co,Fe)17 with R = Ce, Pr, Nd, Sm, Y and MM(Ce-rich mischmetal) have been prepared and their metallurgical and magnetic properties studied. The melting behavior, phase transformations and Curie temperatures, lattice constants and directions of easy magnetization of the R2(Co,Fe)17 phases were determined and the results are presented. All systems except R = Nd have compositional ranges in which the easy direction of magnetization is the c-axis. The praseodymium-cobalt phase diagram has been revised and extended. Three previously unreported intermetallic phases were observed, and the structure of one, Pr2Co1.7, is reported. The design and operation of a thermomagnetic analyzer and of an oscillating specimen magnetometer are described and discussed. Results of thermomagnetic analyses on some of the R2(Co,Fe)17 phases are given and compared with differential thermal analysis measurements. The results of preliminary sintering experiments with NdCo5 and a 70 w/o Pr + 30 w/o Co sintering aid are given. Author

N72-19616# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS: MECHANICAL PROPERTIES OF METALS
J. E. Cambell 10 Nov. 1971 6 p refs
(AD-734116) Avail: NTIS CSCL 11/6

Contents: Elevated-temperature tensile properties of AISI 4140 and 4337 A alloy steels; Elevated-temperature properties of 12 Ni maraging steel plate and welds; Fatigue properties of mill-annealed Ti-6Al-4V alloy at room temperature and 600 F; Comparison of fatigue-crack-growth rates in aluminum alloys, titanium alloys, and alloy steels; Fracture toughness and flaw growth in D6 alloy steel. GRA

N72-19617# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
STRESS CORROSION RESISTANCE OF A NEW HIGH STRENGTH ALUMINUM ALLOY DEVELOPED FOR USE IN THICK SECTIONS Progress Report
Irving S. Shaffer 11 Nov. 1971 14 p refs
(AD-734129; NADC-MA-7168) Avail: NTIS CSCL 11/6

The objective of the investigation was to evaluate the stress corrosion behavior of a new high strength aluminum alloy plate in the T6 and 35 hours at 325 F temperature. Using smooth specimens, stress corrosion tests were conducted in two different laboratory environments. No evidence of stress corrosion cracking was found in any of the test specimens. Exfoliation tests were also conducted on stepped panels which exposed different interior planes through the thickness. The material displayed excellent resistance to exfoliation corrosion.
Author (GRA)

N72-19618# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF THE MECHANICAL BEHAVIOR OF METALS AT HIGH STRAIN IN TORSION Ph.D. Thesis
John E. Lawson Jun. 1971 178 p refs
(AF Proj. 7351)
(AD-734242; DS/MC/71-2) Avail: NTIS CSCL 11/6

A Torsional Split Hopkinson Bar Testing System was developed and analyzed for the existence of higher mode strains in the two elastic bars. The testing device was used to obtain high strain rate data for Aluminum 1100-0, Aluminum 2024-T3 and Titanium 50A. Using the Aluminum 2024-T3 an investigation into the effect of specimen gage length was carried out and from the data for Titanium 50A a plastic strain rate expression of the exponential type was deduced. This expression was used in a numerical plastic wave study and the results compared with the equivalent actual experiments. The effect of changing the constants in the plastic strain rate expression was also investigated. Author (GRA)

N72-19619# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
MARTENSITE TRANSFORMATION DETECTION IN CRYOGENIC STEELS: MAGNETOMETER DEVELOPMENT
F. R. Fickett Dec. 1971 35 p refs
(NAEC Proj. PO-1-8022)
(AD-734425; NBS-TN-613) Avail: NTIS GPO HC $0.40 as C13.46:613 CSCL 11/6

The report presents design criteria for a magnetometer device developed to determine the martensite concentration in 304 stainless steel. Specifically, the device is designed to monitor the cold tank of an airborne liquid oxygen container which is subject to periodic stress pulses. The amount of martensite is relatable to the plastic strain and thus provides a mechanism for the prediction of impending failure.
Author (GRA)

N72-19620# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRODUCE FOR RADIOGRAPHIC STUDY OF RESIDUAL STRESS IN COARSE GRAINED Al4 ALLOYS
A. I. Zharinova 8 Oct. 1971 10 p ref Transl. into ENGLISH from Tr. Politekhn. Inst. (Leningrad), no. 305, 1970 p 10-13
(AF Proj. 6010)
(AD-734990; FTD-HT-23-1272-71) Avail: NTIS CSCL 11/6

A procedure was developed for radiographic determination of residual stresses on coarse-grained cast specimens. Measurements made on specimens subjected to different heat-treatment procedures showed that the accuracy of the method is fully adequate for analysis of the influence of heat treatment on the magnitude of residual stresses. Author (GRA)

N72-19621# Illinois Univ., Urbana. Dept. of Mining Metallurgy and Petroleum Engineering.
ALLOY CHEMISTRY OF THE TRANSITION ELEMENTS Final Report, 1 Oct. 1964 - 31 Aug. 1971
Paul A. Beck 1971 7 p
(Grants DA-ARO(D)-31-124-G609; DA-ARO(D)-31-124-G842; DA-ARO(D)-31-124-G971; DA-ARO(D)-31-124-G85; DA Proj. 200-61102-B-32-D)
(AD-734426; AROD-5103-28-MC) Avail: NTIS CSCL 11/6

The author's research concerned with various aspects of phase equilibria is very briefly summarized. GRA

N72-19622# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISPERSION HARDENING OF COPPER BY TUNGSTEN
B. A. Borok, I. S. Geltman, and Zh. I. Dzneladze 18 Oct. 1971 16 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 3, 1970 p 68-74
(AD-734642; FTD-MT-24-892-71) Avail: NTIS CSCL 11/6

A study was made of copper hardened by inclusions of tungsten of various degrees of dispersion in quantities of 0.5, 1.5, 3.0, 6.0, and 10.0 wt. percent. The compositions were prepared by powder metallurgy methods. The effect of the content and dispersion of the second phase on the submicrostructure, class II stresses, and density of dislocations in the base was demonstrated. The mechanical properties at temperatures up to 1000 C for copper hardened by cold rolling and sintered copper were developed. The effect of the content and dispersion of tungsten on recrystallization and softening of copper was studied. Author (GRA)

N72-19623# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS: LOW TEMPERATURE PROPERTIES OF METALS
J. E. Campbell 19 Nov. 1971 15 p refs
(AD-734712) Avail: NTIS CSCL 11/6

Contents: Low-temperature tensile properties; Properties of cryoworked PH stainless steels; Fracture-toughness and tensile properties of alloys at low temperatures. GRA

N72-19624# Connecticut Univ., Storrs. Inst. of Materials Science.
EFFECTING OF CYCLIC STRAINING ON THE DIFFUSIVITY OF ZINC IN A MAGNESIUM-5.1 PERCENT ZINC-0.6 PERCENT ZIRCONIUM ALLOY
T. Z. Kattamis 15 Jul. 1971 9 p refs
(Contract F44620-69-C-0011; AF Proj. 9560)
(AD-734771; UC-MET-10-71; AFOSR-71-1925TR) Avail: NTIS CSCL 11/6

The work shows that cyclic straining at 310 C enhances the diffusivity of zinc in Mg-5.1% Zn-0.6% Zr grain-refined nondendritic alloy, due to an increased concentration of vacancies in the lattice. This enhancement of diffusivity accelerates the dissolution of the nonequilibrium Mg7Zn3 phase. Author (GRA)

N72-19625# Connecticut Univ., Storrs. Inst. of Materials Science.
CAST MICROSTRUCTURE AND FATIGUE BEHAVIOR OF

A GRAIN REFINED MAGNESIUM-ZINC-ZIRCONIUM ALLOY

A. K. Bhambri and T. Z. Kattamis 15 Jul. 1971 25 p refs
(Contract F44620-69-C-0011; AF Proj. 9560)
(AD-734770; UC-MET-9-71; AFOSR-71-1921TR) Avail: NTIS CSCL 11/6

Microstructure studies were conducted on grain-refined Mg-5.1 pct Zn-0.6 pct Zr alloy plates, sand-cast and end-chilled. Grains in this alloy are spherical, nondendritic and increase in diameter with distance from the chill. Coring in these grains is spherical. The volume fraction of interspherical nonequilibrium secondary phase decreases with distance from the chill, sher as that of microporosity increases. Fatigue strength of this alloy at room temperature was measured in reversed bending at a stress level of 10,000 psi and was found to decrease with increasing distance from the chill, both in the as-cast and the cast and solutionized conditions. Solutionizing was found to increase fatigue life. Author (GRA)

N72-19626# Connecticut Univ., Storrs. Inst. of Materials Science.

A COMPARATIVE STUDY OF SOLUTION KINETICS OF SECONDARY PHASES IN DENDRITIC AND SPHERICAL STRUCTURES

G. Swartzbeck and T. Z. Kattamis 15 Jul. 1971 17 p refs
(Contract F44620-69-C-0011; AF Proj. 9560)
(AD-734769; UC-MET-8-71; AFOSR-71-1922TR) Avail: NTIS CSCL 11/6

A detailed study was undertaken of dissolution and of the various parameters on which it depends. The work reported is a comparative study of solution kinetics of Mg_7Zn_3 in a dendritic Mg-5.1%Zn alloy and a nondendritic grain-refined Mg-5.1%Zn-0.6%Zr alloy. Dissolution is shown to be faster in a spherical structure than in a dendritic structure of the same alloy solidified at the same cooling rate. Author (GRA)

N72-19627# Connecticut Univ., Storrs. Inst. of Materials Science.

CAST MICROSTRUCTURE AND FATIGUE BEHAVIOR OF A HIGH STRENGTH ALUMINUM ALLOY KO-1

K.-H. Chien, T. Z. Kattamis, F. R. Mollard, and H. Mcl. Clark 15 Jul. 1971 35 p refs
(Contract F44620-69-C-0011; AF Proj. 9560)
(AD-734768; UC-MET-7-71; AFOSR-71-1920TR) Avail: NTIS CSCL 11/6

Microstructure and fatigue behavior were studied in sand-cast and end-chilled KO-1 high strength aluminum alloy. Secondary dendrite arm spacing and volume percent microporosity increase with distance from the chill, whereas colume percent interdendritic nonequilibrium secondary phase decreases. The fatigue life of the alloy at room temperature was measured in reversed bending on unnotched specimens at stress levels of 17,300 and 19,000 psi and was found to decrease with increasing distance from the chill. GRA

N72-19628# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.

REVIEW OF RECENT DEVELOPMENT. CORROSION AND COMPATIBILITY

W. E. Berry 17 Dec. 1971 4 p refs
(AD-734938) Avail: NTIS CSCL 11/6

Contents: Aluminum alloys; Iron base alloys; Stainless steels; Nickel and cobalt alloys; Titanium alloys; Miscellaneous. GRA

N72-19629# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.

REVIEW OF RECENT DEVELOPMENTS. TITANIUM AND TITANIUM ALLOYS

R. A. Wood 10 Dec. 1971 4 p refs
(AD-734939) Avail: NTIS CSCL 11/6

Contents: Titanium and Titanium alloys; Economics; Titanium castings; Tables. GRA

N72-19630# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTROMICROSCOPE STUDIES OF THE STRUCTURE OF HEAT RESISTANT ALLOYS AND STEELS

11 Nov. 1971 203 p refs Transl. into ENGLISH of the book "Elektronnomikroskopicheskiye Issledonaniya Struktury Zharoprochnykh Splavov i Staley" 1969 p 5-97
(Contract F33657-71-D-0057)
(AD-734629; FTD-HC-23-335-71) Avail: NTIS CSCL 11/6

Contents: The kinetics of structural changes in nickel-chromium alloys under aging, creep and operating conditions; Study of the fine structure of nickel-chromium alloys by transillumination; The kinetics of the aging process in heat-resistant nickel alloys; The composition and structure of grain boundaries of type XhS alloys after prolonged heating; A study of the structure of maraged steel in the inverse transformation temperature interval; Kinetics of the disintegration of delta-ferrite into transitional steel; The effect of structural and phase transformations on the mechanical properties of titanium alloys; The relation of chemical micro-nonuniformity of titanium alloys to fine structure, mechanical properties, and diffusion mobility of impurities; Study of the disintegration process in titanium alloys with a thermally unstable beta-phase; Study of the nature of individual structural components in single-phase alpha-alloys of titanium; Transillumination study of the fine structure of two-phase titanium alloy VT14; A study of transformation structures in alloys of the Al-Zn-Mg system. GRA

N72-19631# National Materials Advisory Board, Washington, D.C.

TRENDS IN THE USE OF FERROALLOYS BY THE STEEL INDUSTRY OF THE UNITED STATES Final Report

Jul. 1971 134 p refs
(Contract GS-OO-(P)-94008)
(BP-204142; NMAB-276) Avail: NTIS CSCL 11F

The demand for ferroalloy materials by the steel industry was reviewed and projected to 1980 with due consideration of anticipated technological change. National stockpile specifications for these materials were examined and certain specific changes recommended. An improved definition of the superalloy class of materials was developed and a separate reporting of high-strength, lowalloy steel statistics by all data-gathering groups recommended. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-19632*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLIGHT TEST OF CARBON-PHENOLIC ON A SPACECRAFT LAUNCHED BY THE PACEMAKER VEHICLE SYSTEM

Thomas E. Walton, Jr. and William G. Witte Washington Mar. 1972 89 p refs
(NASA-TM-X-2504; L-8098) Avail: NTIS CSCL 11D

Carbon-phenolic material consisting of 50 percent carbon fibers and 50 percent phenolic resin was flight tested on a recoverable spacecraft launched by the Pacemaker vehicle system. The heat shield of the spacecraft was fabricated so that the carbon fibers in the ablator material had different orientations over several areas of the spacecraft. The environment in which the spacecraft was tested produced heating rates on the hemispherical nose up to 13.6 MW/sq m (1200 Btu/sq ft/sec) and stagnation-point pressures up to 1.27 MN/sq m (12.5 atm). The experimental results are presented. Due to high heating rates and possible spallation and mechanical char removal the greatest mass loss occurred in the nose region. Essentially

uniform surface recession and char thickness were observed on the conical section of the spacecraft. A comparison of measured heating rates with computed turbulent and laminar heating rates, as well as measurements of sound-pressure fluctuations in the boundary layer obtained with acoustic sensors, indicated that the boundary layer underwent transition. The acoustic sensor provides an interesting new data form for the general study of boundary-layer transition for free-flight investigations. Author

N72-19633*# Scientific Translation Service, Santa Barbara, Calif.
PREPARATION OF FLUORINE AND ITS COMPOUNDS. 12: A REACTION OF GRAPHITE AND FLUORINE
N. Watanabe and K. Kumon Washington NASA Mar. 1972 17 p refs Transl. into ENGLISH from Denki Kagaku (Japan), v. 35, 1967 p 19-23
(Contract NASw-2035)
(NASA-TT-F-14198) Avail: NTIS CSCL 11D

The reaction between graphite powder and fluorine was studied at 380 to 450 C. Nitrogen and argon were used as diluents. During the reaction a part of the carbon fluoride was decomposed. At the low temperature, the rate determining step was the reaction between fluorine and carbon. At the high temperature, the rate determining step was the diffusion of fluorine into the carbon grains. Author

N72-19634*# Boeing Co., Seattle, Wash. Aerospace Group.
THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF POROUS MATERIAL
J. C. Y. Koh and Anthony Fortini (NASA. Lewis Res. Center) Oct. 1971 49 p refs
(Contract NAS3-12012)
(NASA-CR-120854) Avail: NTIS CSCL 11D

Thermal conductivity and electrical resistivity of porous materials, including 304L stainless steel Rigimesh, 304L stainless steel sintered spherical powders, and OFHC sintered spherical powders at different porosities and temperatures are reported and correlated. It was found that the thermal conductivity and electrical resistivity can be related to the solid material properties and the porosity of the porous matrix regardless of the matrix structure. It was also found that the Wiedermann-Franz-Lorenz relationship is valid for the porous materials under consideration. For high conductivity materials, the Lorenz constant and the lattice component of conductivity depend on the material and are independent of the porosity. For low conductivity, the lattice component depends on the porosity as well. Author

N72-19635*# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs Dept.
PROTECTIVE CLADDINGS FOR HIGH STRENGTH CHROMIUM ALLOYS Final Report
J. F. Collins 15 Sep. 1971 84 p refs
(Contract NAS3-13495)
(NASA-CR-120833) Avail: NTIS CSCL 11C

The application of a Cr-Y-Hf-Th alloy as a protective cladding for a high strength chromium alloy was investigated for its effectiveness in inhibiting nitrogen embrittlement of a core alloy. Cladding was accomplished by a combination of hot gas pressure bonding and roll cladding techniques. Based on bend DBTT, the cladding alloy was effective in inhibiting nitrogen embrittlement of the chromium core alloy for up to 720 ks (200 hours) in air at 1422 K (2100 F). A significant increase in the bend DBTT occurred with longer time exposures at 1422 K or short time exposures at 1589 K (2400 F). Author

N72-19636# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS OF THE GASEOUS PRODUCTS ARISING FROM INSULATION COATINGS ON AIRCRAFT CABLING AT ELEVATED TEMPERATURES
R. I. Butt and J. L. Cotter Jul. 1971 22 p refs
(RAE-TR-71134) Avail: NTIS

The insulation coatings from five commercial aircraft cables were pyrolyzed in an inert atmosphere, and most of the volatile degradation products were identified by combined gas chromatography-mass spectrometry. The principal pyrolysis products of nonfluorine containing insulation systems were carbon monoxide, methane, carbon dioxide, ethylene, propylene and benzene. Insulations based on polytetra fluoro ethylene and a copolymer of hexafluoro propylene/tetrafluoro ethylene gave low molecular weight fluorine containing compounds, as well as carbon monoxide and carbon dioxide. Pyrolysis of an insulation material based on silicone rubber produced appreciable amounts of silicon containing cyclic compounds. Author (ESRO)

N72-19637# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESULTS OF THE EXPERIMENTAL WORK AND STUDIES OF HIGHLY FIRE-PROOF MATERIALS FOR A CHANNEL MGD-GENERATOR
A. I. Rekov 1 Oct. 1971 26 p refs Transl. into ENGLISH from "Materialy dlya Kanala MGD-Genaratora" USSR, 1969 p 9-24
(AF Proj. 3145)
(AD-733854; FTD-MT-24-109-71) Avail: NTIS CSCL 10/2

Experimental research results are given from a study of the thermal stability, evaporability, and electrophysical properties of refractory structural materials. Problems of aging and interaction with other oxides are discussed for zirconium dioxide based oxidation systems. Detailed results are given from work on the synthesis and research of the properties of silicon carbide and its compositions with high melting point metals (molybdenum and titanium, etc.). Results are given from the study of materials under normal conditions of an open cycle MHD generator channel. GRA

N72-19638# Princeton Univ., N.J. Dept. of Chemical Engineering.
TORSIONAL BRAID ANALYSIS. A SEMIMICRO THERMOMECHANICAL APPROACH TO POLYMER CHARACTERIZATION Technical Report, Sep. 1969 - Nov. 1971
John K. Gillham Nov. 1971 228 p refs Submitted for publication
(Contract N00014-67-A-0151-0024)
(AD-734005; TR-4) Avail: NTIS CSCL 11/9

Torsional Braid Analysis (TBA) is an easy and yet sophisticated method for obtaining and understanding the mechanical behavior of bulk polymers. A multifilament inert (glass) braid is impregnated with polymer to form a specimen which is subjected to a series of freely damped torsional oscillations in a torsional pendulum experiment, without limitation with respect to the mechanical state (glassy, rubbery or fluid) of the sample. This unique approach of 'chemistry on a string' permits the in situ investigation of the effect of reactive and physical processes on the mechanical properties of polymers and thereby bridges a traditional gap between synthetic and physical polymer science. In this review, the present status of the concept, the instrumentation, the technique of application, and application to selected pragmatic, novel and theoretically interesting polymers are highlighted. Author (GRA)

N72-19639# Aerospace Corp., El Segundo, Calif. Office for Technology.
THERMOELASTIC ANALYSIS AND TEST CORRELATION OF LOW THERMAL EXPANSION COMPOSITE MATERIAL LAMINATES Technical Report, Oct. 1970 - Feb. 1971
D. E. Geiler 15 Jul. 1971 87 p refs
(Contract F04701-71-C-0172)
(AD-734033; TR-0172(2360-03)-1; SAMSO-TR-71-212) Avail: NTIS CSCL 11/4

Thornel 75S/ERLB 4617 Graphite-Epoxy composite material laminates configured for isotropic low thermal expansion characteristics were analyzed for correlation of analytically predicted thermal structural response with test data. Panels analyzed included solid laminates of three and six layers and

aluminum honeycomb sandwich panels of three and six layer laminated facesheets. It was concluded that macromechanical elastic analysis can be used to satisfactorily predict the thermo-elastic response of multi-layer, multi-angular, graphite-epoxy laminates. Author (GRA)

N72-19640# North Carolina State Univ., Raleigh.
EXPERIMENTAL INVESTIGATION OF LARGE-AMPLITUDE ELASTIC WAVE PROPAGATION AND THE ELASTIC-PLASTIC TRANSITION IN POLYCARBONATE (LEXAN)
W. L. Liddell, R. S. Steele, W. L. Bingham, and R. A. Douglas Dec. 1971 43 p refs
(Contract N00014-68-A-0187; NR Proj. 064-504)
(AD-733992; TR-71-6) Avail: NTIS CSCL 11/9

An experimental system for determining strain-time and surface rotation-time histories during axial impact of rods is used to investigate the propagation of large-amplitude elastic strain waves and the elastic-plastic transition in polycarbonate (Lexan) rods. Author (GRA)

N72-19641# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ESTIMATION OF THE ANTIOXIDANTS EFFICIENCY USING DTA AND THERMOGRAVIMETRY
Wanda Kosinka and Elzbieta Dragowska 18 Oct. 1971 15 p Transl. into ENGLISH from Polimery (Poland), v. 15, no. 10, 1970 p 525-527
(AF Proj. 7343)
(AD-734226; FTD-HC-23-858-71) Avail: NTIS CSCL 11/9

The applications of DTA and thermogravimetry for estimation of the antioxidants efficiency used for polymers are described. Using polyethylene and polystyrene as the examples, a method of rapid estimation of the antioxidant efficiency and its optimum concentration, evaluation with an analysis of the DTA trace is described. GRA

N72-19642# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
INSTABILITY OF GLASS FIBER REINFORCED PLASTIC PANELS UNDER AXIAL COMPRESSION
Bruce Theodore Willey Sep. 1971 63 p refs
(Contract DA-44-177-AMC-115(T); DA Proj. 1F1-62204-A-170)
(AD-734340; USAAVLABS-TR-69-48) Avail: NTIS CSCL 11/4

The report shows that the so-called strain reversal method is of little value in interpreting test data obtained on compressed panels. At the same time it demonstrates that the Southwell and large displacement techniques both give results associable with theory. Author (GRA)

N72-19643# Watervliet Arsenal, N.Y.
WAVE PROPAGATION AND VIBRATIONS IN FIBER REINFORCED COMPOSITES
Gary L. Anderson Jun. 1971 80 p refs
(DA Proj. 1F0-61102-A-35-D)
(AD-734295; WVT-7133) Avail: NTIS CSCL 11/4

A mathematical model for unidirectional fiber-reinforced composite materials is developed. This theory is founded on the assumption that the fibers may be treated as Euler-Bernoulli beams. The elastic moduli are assigned numerical values on the basis of recently published data obtained through ultrasonic measuring procedures. Certain boundary value problems formulated in this theory of composites are found to be identical to the corresponding boundary value problems that arise in the theory of couple-stresses. The thickness-shear, thickness-stretch, and thickness-twist modes are studied, and the dispersive characteristics of surface waves and Love waves are investigated. All results are compared with the solutions of the same problems formulated within the framework of the so-called effective modulus theory. Author (GRA)

N72-19644# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
DEVELOPMENT OF A CHEMICAL COATING FOR AIRFIELD RUNWAY MARKING
Harvey Miller and Stanley P. Dowdy Sep. 1971 81 p refs
(Contract DOT-FA69WA-1154)
(AD-734320; USAMERDC-2012) Avail: NTIS CSCL 11/3

The purpose of the project was to develop an airfield runway marking system that would be superior to systems presently utilized. A high-molecular-weight, linear Bisphenol polyether was developed. A balanced ketonic-alcoholic-aromatic hydrocarbon solvent was found to be the most effective solvent to give rapid through-dry, flexibility, and a minimum of reactivity with the substrate. Three different antiskid additives were studied as well as a siloxane-type additive to improve bead retention and adhesion of the coating to the substrate. A styrene acrylate and a chlorinated rubber alkyd have also been evaluated. Author (GRA)

N72-19645# Catholic Univ. of America, Washington, D.C. Vitreous State Lab.
CHEMICAL STRUCTURE AND PROPERTIES OF MOLTEN GLASS RELATED TO OPTICAL, INFRARED, AND STRUCTURAL MATERIALS Final Report
Pedro B. Macedo Dec. 1971 10 p refs
(Grant AF-AFOSR-1376-68; AF Proj. 9537)
(AD-734263; AFOSR-71-3124TR) Avail: NTIS CSCL 11/2

The research had as a primary goal the understanding of the basic chemical structure of glasses and their melts. Summarized is the research leading to the understanding of ionic migration in liquids and glasses, development of a chalcogenide glass ceramic for infrared windows, and use of laser light scattering to study composition fluctuations in liquids and glasses. Author (GRA)

N72-19646# Northwestern Univ., Evanston, Ill. Materials Research Center.
[INTERDISCIPLINARY MATERIALS RESEARCH] Annual Report, 1 Oct. 1970 - 30 Sep. 1971
30 Sep. 1971 219 p refs
(Contract DAHC15-67-C-0213)
(AD-733946; AR-12) Avail: NTIS CSCL 11/7

The report summarizes research from October 1970 to September 1971 at the Materials Research Center at Northwestern University. GRA

N72-19647# Watervliet Arsenal, N.Y.
METAL MATRIX COMPOSITES FOR HIGH TEMPERATURE APPLICATION Interim Progress Report, 1971
Iqbal Ahmad, J. M. Barranco, K. E. Loomis, and W. J. Heffernan Oct. 1971 94 p refs
(DA Proj. 1T0-62105-A-331)
(AD-734304; WVT-7155) Avail: NTIS CSCL 11/4

The objective of the program is to develop fabrication techniques and to characterize high strength-high temperature filament reinforced superalloys for application as turbine blade materials. Using the sessile drop and infiltration techniques, the compatibility of W and SiC filaments against castable superalloys including Mar M200, Mar M302, Mar M322, J-1650, and IN-100 was investigated. Author (GRA)

N72-19648# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
CHEMICAL VAPOR DEPOSITION STUDY Final Report
Dec. 1971 25 p refs Sponsored in part by ARPA
(AD-734212; UTEC-MSE-71-238) Avail: NTIS CSCL 11/3

The report discusses research on chemically vapor deposited (C.V.D.) tungsten. It was of interest to learn the mechanism by which the WF6 molecule was reduced by H2 on the substrate and also what was the mechanism by which the deposit grew. The effect of annealing on the mechanical properties of C.V.D. tungsten was studied in the temperature range of 800 to 1600 C by hoop stress tests. GRA

N72-19649# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
INVESTIGATION OF THE INFLUENCE OF STRUCTURE ON CHEMICAL STABILITY AND THERMAL/MECHANICAL SHOCK PROPERTIES OF GLASS-LIKE CARBONS
Semiannual Technical Report, 2 May - 2 Nov. 1971
Garth L. Tingey 1 Dec. 1971 43 p refs
(Contract DAHC15-71-C-0248; ARPA Order 1830)
(AD-734211; BNW-211B00718) Avail: NTIS CSCL 11/2

The study was instituted to investigate the chemical reactivity and thermal and mechanical shock behavior of glass-like carbons and to correlate these properties with observable structural features. Reactivity studies were selected for initial work. Shock property measurements were incorporated into the program to gain an insight into a potential weakness of glass-like carbon. The reactivity studies were limited to rate measurements of various carbon forms with oxygen. Rate measurements have been conducted on two types of glass-like carbons ('Glassy' carbon and 'Carbone Vitreux'), an amorphous pyrocarbon, and a standard nuclear graphite. GRA

N72-19650# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
SOME RECENT EXPERIMENTAL INVESTIGATIONS IN STRESS-WAVE PROPAGATION AND FRACTURE
H. Kolsky Jun. 1971 39 p refs
(Contract DA-31-124-ARO(D)-358)
(AD-729824; AROD-5606-16-E; TR-19) Avail: NTIS CSCL 11/10

The paper describes preliminary results of three distinct experimental programs at present being carried out by the author and his colleagues at Brown University. These are: (a) Rubber is found to have a stress-strain curve which is concave upwards for tensile strains. As a result of this, tensile pulses of reasonably large amplitudes are found to develop shock fronts when they are propagated along rubber filaments which are already subjected to large tensile pre-strains. Experiments illustrating this effect are described, and a discussion of the conditions for such shock-wave formation is given. (b) When a fracture occurs in a brittle solid, there is a sudden local change in stress and a compressive stress pulse is propagated away from the crack. Experiments are described concerning the generation of such pulses for Hertzian fractures, simple tensile fractures, and flexural fractures. (c) When a longitudinal stress pulse is reflected at normal incidence at the boundary between two solids of different properties, two pulses are, in general, produced. A reflected pulse is sent back, and a transmitted pulse is propagated in the second medium. Author (GRA)

N72-19651# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTION OF ALUMINUM IN A MARINE CLIMATE
L. Strat and L. Oprean 19 Oct. 1971 10 p Transl. into ENGLISH from Rev. Construct. Material. Construct. (Bucharest), v. 21, no. 9, 1969 p 477-479
(AF Proj. 6010)
(AD-734864; FTD-HC-23-964-71) Avail: NTIS CSCL 11/3

The following conclusions were drawn from the experiments: anodic oxidation compacted with organic dyes, applied on polished aluminum exhibited the best behavior; unpolished aluminum requires a 20 mu m thick layer to ensure a service life of more than 5 years; in order to retain the decorative appearance, a sunlight-resistant dye must be used; painting of the aluminum is very efficient, assuming that the paints are resistant against the environment to which they are exposed. Author (GRA)

N72-19652# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ADHESIVES FOR SPACE SYSTEMS
George Epstein 15 Sep. 1971 61 p refs
(Contract F04701-71-C-0172)
(AD-734759; TR-0172(2250-01)-1; SAMSO-TR-71-296) Avail: NTIS CSCL 11/1

Adhesives are used extensively in space systems, both manned and unmanned, for a wide variety of important and critical applications. Reasons for using adhesives are briefly reviewed. The requirements for space applications are presented. Typical space applications are described, including problems that have been encountered and resolved. Detailed discussions are presented of the use of adhesives in solar panels, second-surface mirrors, detector assemblies, radiators, multilayer circuit boards, antennas, tubular members, platforms, equipment-mounting panels, lunar and planetary landing components, reentry heat shields, launch vehicle components, and various Apollo spacecraft components. Author (GRA)

N72-19653# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURE OF TITANIUM NICKEL PIGMENTS
G. V. Kleshchev, A. I. Sheinkman, L. M. Goldshtein, and V. N. Turlakov 14 Oct. 1971 13 p refs Transl. into ENGLISH from Lakokrasoch. Mater. Ikh Primen. (Moscow), no. 4, 1970 p 12-14
(AF Proj. 7343)
(AD-734908; FTD-HT-23-1139-71) Avail: NTIS CSCL 11/3

In the article the authors discuss the formation mechanism of titanium nickel pigments. Pigments based on two- and three-component systems are the objects of study. The pigments were prepared from the given hydrate, nickel carbonate, and antimony trioxide. The mixture of the original components was thoroughly pulverized until the ingredients were completely mixed; then it was dried and baked at 1000 C for 1-9 hours. GRA

N72-19654# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TENSOMETRIC FRICTION MACHINE FOR TESTING PLASTICS
V. N. Egorov 8 Oct. 1971 12 p refs Transl. into ENGLISH from Kubansk. Selskokhozyaistvennyi Inst., Tr. (Krasnodar, USSR), no. 13, 1968 p 264-268
(AF Proj. 7343)
(AD-734862; FTD-HT-23-1093-71) Avail: NTIS CSCL 11/9

A dynamic friction meter was designed and tested. It consists of a rotating steel disc against which a plastic sample is pressed with a known force, a regulating system which maintains the desired rpm rate and contact pressure, and a recorder which automatically plots the horizontal frictional force. Author (GRA)

N72-19655# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
COMPRESSIVE BEHAVIOR OF FIBER COMPOSITES
Oscar Orringer Oct. 1971 205 p refs
(Contract F44620-70-C-0020; AF Proj. 9782)
(AD-734789; ASRL-TR-162-1; AFOSR-71-3098TR) Avail: NTIS CSCL 11/4

The mechanical behavior of model composite specimens consisting of unidirectional piano-wire fibers in a matrix of Emerson and Cuming STYCAST 1264 was studied with compressive loading applied parallel to the fiber axis. Tests were conducted at temperatures ranging from 65 to 110 F, as a means of varying the matrix material Young's modulus while keeping the fiber properties constant. Author (GRA)

N72-19656# Texas Univ., Austin.
AN EXPERIMENTAL INVESTIGATION OF THE SHEAR CREEP OF FIBER REINFORCED VISCOELASTIC MATERIALS
Barry K. Benedict and Harry H. Calvit Oct. 1971 32 p refs
(Contract DAAD05-69-C-0241)
(AD-734880; BRL-CR-58) Avail: NTIS CSCL 11/4

A mathematical model describing the behavior of the class of composite material consisting of a linear viscoelastic matrix reinforced by continuous elastic fibers was previously proposed

by Nachlinger and Calvit. The accuracy of this model was not verified experimentally for complicated orientations of the fibers, however. This report presents results of an experimental investigation of this aspect of the theory by considering the problem of simple shear. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-19657 National Lending Library for Science and Technology, Boston Spa (England).

THE RELATIONSHIP BETWEEN LAGRANGE AND EULER CORRELATION FUNCTIONS

H. W. Franz 28 Dec. 1971 32 p refs Transl. into ENGLISH from report of Meteorol. Inst., Tech. Univ., Darmstadt, West Germany, 30 Nov. 1968

(NLL-CE-Trans-5571-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

Starting with a vortex model, taking account of the change of the vortex with time to a first approximation and using the Navier-Stokes equations, two systems of three integral equations each were set up for the Lagrange and the Euler correlation functions. Two methods are given which enable two constants of unknown magnitude to be determined. The case of isotropic turbulence is considered. Author

N72-19658*# Texas Univ., Dallas.

ON THE METHOD OF ERMAKOV AND ZOLOTUKHIN FOR MULTIPLE INTEGRATION

R. Cranley and T. N. L. Patterson [1971] 17 p refs

(Grant NGL-44-004-001)

(NASA-CR-125808; SP-71-021) Avail: NTIS CSCL 12A

By introducing the idea of pseudo-implementation, a practical assessment of the method for multiple integration is made. The performance of the method is found to be unimpressive in comparison with a recent regression method. Author

N72-19659*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

DETERMINATION OF STABILITY DERIVATIVES FROM FLIGHT DATA USING A NEWTON-RAPHSON MINIMIZATION TECHNIQUE

Kenneth W. Iliff and Lawrence W. Taylor, Jr. Washington Mar. 1972 59 p refs

(NASA-TN-D-6579; H-626) Avail: NTIS CSCL 12A

A modified Newton-Raphson or quasilinearization minimization technique for determining stability derivatives from flight data was developed and compared with simple-equations, analog-matching, least-squares, and Shinbrot methods of analysis. For the data analyzed, the solutions computed by using the estimates obtained from the Newton-Raphson technique fit the dwta and determined coefficients adequately. A further modification to include a priori information was found to be useful. A model statistically similar to the flight data was analyzed using the same methods (excluding analog matching), and the Newton-Raphson technique was found to yield superior estimates. An approximate Cramer-Rao bound was compared with the error covariance matrix of the model and was found to provide information about the reliability of the individual estimates obtained. The technique was successfully applied to data obtained from a light airplane, a large supersonic airplane, and a lifting body vehicle. It was shown that the reliability of the estimates of a given coefficient obtained from these vehicles depends upon the data analyzed. Author

N72-19660# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). AVA-Abteilung Raumfahrtaerodynamik.

ON THE OPTIMIZATION OF SKIMMER GEOMETRIES

U. Bossel Jul. 1971 28 p refs Presented at 3d Intern. Symp. on Mol. Beams, Cannes, France, 29 Jun. - 2 Jul. 1971

(DLR-FB-71-50; AVA-Fb-7117) Avail: NTIS

The design of skimmers was re-examined with respect to the production of nozzle beams of optimum intensity and collimation. The geometric parameters studied include the skimmer diameter, lip radius, and skimmer length, as well as the internal and external cone angles. Irrespective of the state of rarefaction of the incoming flow, a slender skimmer of sufficient length appears to be most desirable for the attainment of intense beams of near-isentropic properties. Author

N72-19661*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CLASSICAL EIGHT- AND LOWER-ORDER RUNGE-KUTTA-NYSTROEM FORMULAS WITH STEPSIZE CONTROL FOR SPECIAL SECOND-ORDER DIFFERENTIAL EQUATIONS

Erwin Fehlberg Washington Mar. 1972 66 p refs

(NASA-TR-R-381; M-533) Avail: NTIS CSCL 12A

The formulas include a stepsize control procedure, based on a complete coverage of the leading term of the truncation error in x. The formulas require fewer evaluations per stop than other Runge-Kutta-Nystrom formulas if the latter are operated by using the standard procedure for stepsize control. An example is presented. With results being of the same accuracy, Runge-Kutta-Nystrom formulas discussed save 50 percent or more computer time compared with other Runge-Kutta-Nystrom formulas.

Author

N72-19662*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

NTH-ORDER FLAT APPROXIMATION OF THE SIGNUM FUNCTION BY A POLYNOMIAL

Hans H. Hosenthien Washington Mar. 1972 33 p refs

(NASA-TN-D-6688; M-212) Avail: NTIS CSCL 12A

In the interval studied, the signum function, sgn x, was demonstrated to be uniquely approximated by an odd polynomial f sub n (x) of order 2n-1, for which the approximation is nth order flat with respect to the points (1,1) and (-1,-1). A theorem was proved which states that for even integers $n > or = 2$, the approximating polynomial has a pair of nonzero real roots + or - x sub n such that the x sub n form a monotonically decreasing sequence which converges to the root of 2 as n approaches infinity. For odd $n > i$, f sub n (x) represents a strictly increasing monotonic function for all real x. As n tends to infinity, f sub n (x) converges to sgn x uniformly in two interval ranges. Author

N72-19663# Technische Hogeschool, Delft (Netherlands).

A METHOD FOR THE DETERMINATION OF THE OPTIMUM FEEDBACK FOR A CONSTANT LINEAR DYNAMIC SYSTEM WITH FEEDBACK CONSTRAINTS

P. P. van den Broek Jan. 1971 51 p refs

(VTH-165) Avail: NTIS

A dynamic system is represented by n linear first differential equations with constant coefficients. It is assumed, that the m input variables are linearly dependent on the n state variables. The feedback gains are considered to be optimal, if the infinite time integral of a positive definite quadratic functional of the state variables and the input variables are minimized, for a given initial state of the system. Equations were derived for optimal feedback. These equations are valid if all feedback gains were chosen arbitrarily and if one or more feedback gains are subjected to constraints. If one or more state variables cannot be fed back, the solution of the equations is subject to the constraint that the corresponding feedback gains be equal to zero. In this case the optimum depends on the initial condition of the system. Two iteration methods are suggested to solve the equations. Author (ESRO)

N72-19664# Rome Univ. (Italy). Inst. of Physics.
CALCULATION OF CRITICAL INDICES
G. Parisi (CNEN, Frascati, Italy) and L. Peliti 12 Jun. 1971 7 p refs
(Nota-Interna-322) Avail: NTIS

An approximation is found from which the calculation of critical indices for the lambda point of Bose liquids is reduced to quadratures. Author (ESRO)

N72-19665# Texas Univ., Austin. Electronics Research Center.
ON THE CONTROLLABILITY OF NONLINEAR SYSTEMS
Kais B. Mirza and Baxter F. Womack 8 Jun. 1971 125 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-734045; TR-105; AFOSR-71-1969TR) Avail: NTIS CSCL 12/1

Controllability of several classes of nonlinear systems described by nonlinear differential equations is studied. In a similar approach to the one used in the theory of differential equations to establish the existence of a solution, the fixed point theorem is used to establish the existence of a control function for a certain system which transfers the initial state of the system to the origin in a finite time. Author (GRA)

N72-19666# Stanford Univ., Calif. Dept. of Operations Research.
REALIZATION OF CONTINUOUS-TIME LINEAR DYNAMICAL SYSTEMS: RIGOROUS THEORY IN THE STYLE OF SCHWARTZ
R. E. Kalman (Fla. Univ., Gainesville) and M. L. J. Hautus (Tech. Hogeschool, Eindhoven, Neth.) Dec. 1971 20 p refs Submitted for publication Sponsored in part by Neth. Organ. for the Advan. of Pure Res. Prepared in cooperation with Fla. Univ., Gainsville and Tech. Univ., Eindhoven, Neth.
(Contract DA-31-124-ARO(D)-394; Grant AF-AFOSR-1898-70; AF Proj. 9749)
(AD-734281; AFOSR-71-3110TR) Avail: NTIS CSCL 12/1

The paper gives a rigorous definition of the input/output map of a linear constant dynamical system using generalized functions in the style of Schwartz. It is proved, using only natural constructions, that the minimal realization of such a system is governed by linear differential equations with constant coefficients (in the sense of Kalman). This is the first time such a result has been obtained; previous work required ad-hoc assumptions or lacked rigor. As a result of the theory developed in this paper, precise conditions are now known for the applicability of module theoretic-methods to the theory of continuous-time linear systems. Author (GRA)

N72-19667# Naval Postgraduate School, Monterey, Calif.
INTRODUCTION TO DIMENSIONAL ANALYSIS AND THE THEORY OF NATURAL UNITS
T. H. Gawain Dec. 1971 29 p refs
(AD-734980; NPS-57GN71121A) Avail: NTIS CSCL 12/1

The report presents a somewhat abbreviated introduction to dimensional analysis for students of science or engineering. It shows how to construct a system of consistent natural units appropriate to any given physical problem or context. It also explains how the well known Pi Theorem of dimensional analysis follows from this treatment, and how the dimensionless pi's of the theorem simply represent various physical quantities of interest as expressed in such natural units. The method is illustrated by application to the case of an ideal propeller. This example shows how dimensional analysis may be used to generalize and simplify a problem, and to extract the maximum degree of useful information and insight from its solution. Author (GRA)

N72-19668# Army Foreign Science and Technology Center, Charlottesville, Va.
THE STABILITY OF THE DISPERSION METHOD WHEN DIFFERENCE METHODS ARE USED FOR THE HEAT CONDUCTION AND WAVE EQUATIONS
E. C. Nikolaev 9 Sep. 1971 11 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. Fiz. (USSR), v. 10, no. 2, Mar. - Apr. 1970
(FSTC Proj. T7023012301)
(AD-735000; FSTC-HT-23-1551-71) Avail: NTIS CSCL 12/1

The author proves the stability of the dispersion method on the upper layer, making the assumption that certain methods approximating the first boundary value problem of the heat conduction and wave equations are stable with respect to the initial conditions. Author (GRA)

N72-19669# White Sands Missile Range, N.Mex. Atmospheric Sciences Lab.
SOME EFFECTS OF RANDOMIZATION IN HYPOTHESIS TESTING WITH CORRELATED DATA
Elton P. Avara Oct. 1971 40 p refs
(DA Proj. 1T0-61102-B-53-A)
(AD-734821; ECOM-5408) Avail: NTIS CSCL 12/1

The effects of each of four different randomization schemes upon the Student's-T test statistic are investigated under the assumption that the data are correlated. Two specific correlation matrices are considered. The results indicate that the statistic /T/ may be biased either too large or too small to be reliable in hypothesis testing. Whether /T/ is biased or unbiased depends upon the randomization scheme chosen. Author (GRA)

N72-19670# Louisiana State Univ., Baton Rouge. Coll. of Engineering.
STUDIES IN DIGITAL AUTOMATA Quarterly Progress Report, 1 Sep. - 30 Nov. 1971
Cecil L. Smith 30 Nov. 1971 40 p refs
(Contract F44620-68-C-0021; AF Proj. 9769; Proj. Themis)
(AD-734799; AFOSR-72-0017TR) Avail: NTIS CSCL 12/1

The report contains publications and discussions in the fields of control theory, process control, game theory, and automata theory. GRA

N72-19671# Naval Postgraduate School, Monterey, Calif.
DIMENSIONAL ANALYSIS AND THE THEORY OF NATURAL UNITS
T. H. Gawain Oct. 1971 117 p refs
(AD-735128; NPS-57-GN71101A) Avail: NTIS CSCL 12/1

The document has been prepared as a text on dimensional analysis for students of aeronautics at this school. It develops the subject from a viewpoint which is inadequately treated in most standard tests but which the author's experience has shown to be valuable to students and professionals alike. The analysis treats two types of consistent units, namely, fixed units and natural units. Fixed units include those encountered in the various familiar English and metric systems. Natural units are not fixed in magnitude once and for all but depend on certain physical reference parameters which change with the problem under consideration. Detailed rules are given for the orderly choice of such dimensional reference parameters and for their use in various applications. Author (GRA)

N72-19672# RAND Corp., Santa Monica, Calif.
THE FALLACY OF CAUSAL ANALYSIS
Ralph E. Strauch Apr. 1971 10 p refs
(AD-731651; P-4618) Avail: NTIS CSCL 12/1

The technique of causal analysis--the use of correlation coefficients as a tool to distinguish between alternative causal patterns among variables--is a popular one in the social sciences. The heuristic justification for the technique is superficially convincing and indeed, can be shown to have some theoretical foundation in a rather straightforward mathematical model. Moreover, the assumptions made in this model often appear to be reasonable first approximations to the structure of interest in the real world. The fallacy of the technique, however, stems from the way in which the assumptions drive the conclusions reached. The conclusions are driven not by the linear relationships chosen to approximate the real world relationships of interest,

but rather by a specific detail in the model chosen as a mathematical convenience--the assumption of statistical independence of the residual terms in the systems of equations (causal pattern) which makes the residuals appear most nearly independent. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-19673 National Lending Library for Science and Technology, Boston Spa (England).

AN EXAMPLE OF THE USE IN FORECASTING OF THE PRINCIPLE OF DIVIDING VALUES OF THE PREDICTAND INTO RANGES AND SUBSEQUENTLY CORRECTING THE VALUES IN EACH RANGE USING VARIOUS PREDICTORS

E. M. Kozik. [1971] 10 p ref Transl. into ENGLISH from Tr. Leningr. Gidrometeorol. Inst. (Leningrad), v. 47, no. 62, 1970 p 164-170

(NLL-M-22064-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An objective method for forecasting strong easterly winds for the region of Ursatevskaja (100 km south of Tashkent) is described. Predictors which were the differences between values of meteorological parameters at selected grid points or stations were selected, and grouped according to their relationship into generalized predictors. A generalized predictor which covered 80% of the strong easterly winds was found. F.O.S.

N72-19674 National Lending Library for Science and Technology, Boston Spa (England).

ON THE PRINCIPLE CYCLES IN OSCILLATIONS OF AMOUNTS OF PRECIPITATION AND THE ATMOSPHERIC CIRCULATION

O. A. Drozdov [1970] 7 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), v. 258, 1970 p 56-63

(NLL-M-22079-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Precipitation and atmospheric circulation cycles were studied by analyzing cyclic components of precipitation and circulation for 77 stations in the USSR. It was found that for precipitation the two-year cycle is one of the most frequent. For the circulation cycles the greater amplitude occurs at 8 to 9 years, and a secondary amplitude at 10 to 11 years. It is concluded that a system of principal waves with weighted conditions can be used for forecasting. F.O.S.

N72-19675 National Lending Library for Science and Technology, Boston Spa (England).

ON THE INFLUENCE OF THE CITY ON PRECIPITATION DISTRIBUTION FROM HEAVY RAINFALL IN HAMBURG

R. Reidat [1971] 7 p Transl. into ENGLISH from Wetter Leben (Vienna), v. 23, 1971 p 1-6

(NLL-M-22082-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Charts of days with 20mm or more of rainfall are drawn in an attempt to determine the effects of a city or town on rainfall patterns. One hundred such charts were examined for Hamburg with major emphasis on rainfall patterns of days with thunderstorms and on occasions of heavy rainfall with thunder. Results show towns with orographic features tend to have more rainfall than flat areas, and rain is more intense. E.H.W.

N72-19676 National Lending Library for Science and Technology, Boston Spa (England).

ON THE POSSIBILITY OF FORECASTING INTEGRAL PARAMETERS OF THE GENERAL CIRCULATION OF THE ATMOSPHERE IN TERMS OF THEIR PRINCIPAL COMPONENTS

G. V. Gruza and E. N. Milohova [1970] 9 p refs Transl. into ENGLISH from Sredneaz. Nauch. Issled. Gidromet. Inst. (Leningrad), v. 47, no. 62, 1970 p 59-67

(NLL-M-22077-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Various parameters of general atmospheric circulation were calculated from geopotential field values. These parameters included local zonal circulation index, density of meridional flux and flux divergence of specific angular momentum, geopotential variations per 24-hour period, specific kinetic energy and specific energy of zonal and meridional motion, density of meridional flux and flux divergence of specific kinetic energy, and spatial variability of specific kinetic energy in 24 hours. The method of calculation and the expansion by series of a meteorological field in a system of functions are presented. The possibility is discussed for using the calculated integral parameters in regression equations for weather forecasting. The best predictor for forecasting circulation index is the circulation index itself. The total kinetic energy, energy of zonal motions, and density of meridional energy flux are most useful in predicting kinetic energy. It was concluded that principal components of circulation parameters are not always the best for forecasting purposes. The predictability of circulation parameters depends on the forecasting region and decreases with increasing advance time of prediction. K.P.D.

N72-19677 National Lending Library for Science and Technology, Boston Spa (England).

CHARACTER OF THE MANIFESTATION OF DIFFERENT TYPES OF DISTURBANCES ON THE SUN IN THE ATMOSPHERIC CIRCULATION

V. F. Loginov [1970] 8 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), V. 258, 1970 p 18-23

(NLL-M-22080-(5828.4F)) Avail.: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The ways in which different processes on the sun are manifested in the troposphere were studied. The basic solar activities considered were large chromospheric flares accompanied by absorption of radio waves, and sporadic disturbances of the earth's magnetic field. The basic atmospheric process considered was the atmospheric circulation for the whole Northern Hemisphere. It was found that the ratio of zonal to meridional circulation rises sharply on the day after a flare, and then returns to the state of circulation before the flare in 6 to 8 days. Similar effects were observed with geomagnetic disturbances. F.O.S.

N72-19678 National Lending Library for Science and Technology, Boston Spa (England).

THE ORIGIN OF THE DRY MIDSUMMER OF 1969 IN CENTRAL EUROPE

R. Scherhag [1970] 8 p Transl. into ENGLISH from Magyar. Met. Tars. Foly. Idoj. (Budpest), v. 74, 1970 p 313-318

(NLL-M-22076-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An analysis of climatological tendencies based on weather conditions is presented for the period preceding midsummer of 1969 in central Europe. The advantages of observing pressure change centers for meteorological prediction are discussed. K.P.D.

N72-19679 National Lending Library for Science and Technology, Boston Spa (England).

MESO-SCALE STRUCTURE OF THE WIND FIELD IN JET STREAMS

L. M. Velicenko, V. D. Litvinova, and N. P. Sakina [1970] 9 p refs Transl. into ENGLISH from Cent. Aerol. Obs. (Moscow), v. 97, 1970 p 85-91

(NLL-M-22072-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An attempt is made to distinguish and compare the fields of meso-scale disturbances in the neighborhood of jet streams to

vertical and horizontal wind shear and temperature stratification of mean flow. Data from flights around the Har'hov region in the summer of 1966 and the winter of 1967 are used for the study. Results show that details of the vertical structure of the meso-scale systems are poorly 'caught' while the horizontal systems can be distinguished. Author

N72-19680 National Lending Library for Science and Technology, Boston Spa (England).
PREDICTORS FOR THUNDERSTORM FORECASTS
Yasukichi Fuse [1971] 10 p refs Transl. into ENGLISH from Kishocho Kenkyu Jiho (Tokyo), v. 22, 1970 p 541-545
(NLL-M-22056-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of re-examining predictors are considered for forecasting thunderstorms and an experimental potential forecast is suggested which may yield a quantitative expression, which is based on a method of forecasting in use in the Sendai meteoroloical district, Japan. The subject of investigations were the thunderstorms during the months of June to August in the years 1961 to 1965 in the Kanto district and the Yamanashi, Nagano, and Shizuoka prefectures. The forecast predictors were calculated on the basis of the values observed at 0900 hours at Tateno during the same periods. Author

N72-19681 National Lending Library for Science and Technology, Boston Spa (England).
GRAVITY WAVES AND INSTABILITY OF JET STREAMS
Z. N. Kogan [1971] 15 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 2, 1971 p 44-56
(NLL-M-22070-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The problem of meso-scale waves and stability of jet streams in a thermal stratified atmosphere is considered. The basic flow is assumed to be plane parallel and inviscid, and the wave disturbances small. The structure of the part of the spectrum which corresponds to neutral nonsingular (gravity) waves was studied, and estimates of the phase velocities of these were obtained. Euler's series method and the method of successive approximations were used to find phase velocities and amplitude functions of neutral nonsingular waves and the complex phase velocity of a growing disturbance. The dependence of the values obtained on wavelength and stability was studied. It was found that gravity waves can only originate from a particular instability. Author

N72-19682 National Lending Library for Science and Technology, Boston Spa (England).
CAT INVESTIGATIONS IN THE STRATOSPHERE
N. K. Vinnicenko, N. Z. Pinus, and G. N. Sur [1971] 11 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), v. 100, 1970 p 86-98
(NLL-M-22069-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Results of experimental studies of turbulence in the stratosphere on a specially equipped high altitude subsonic aircraft flying over mountains and plains are considered. Data on the geometry and structure of zones of turbulence are obtained. In the stratosphere, as in the troposphere, there are local zones of turbulence, but the extent and depth of these zones are much less in the stratosphere. Zones of turbulence in the stratosphere are considerably more intense over mountains than over plains, because the stratosphere is made turbulent by breaking mountain waves. Examples of the distribution of zones of turbulence with respect to the tropopause and the level of maximum wind are given. Correlation and spectral characteristics of CAT in the stratosphere are also given. Some correlation functions have a harmonic tail which is not damped; this suggests that there are wave motions in the stratosphere. Power spectra of the horizontal wind component in the stratosphere, covering the meso-scale and micro-scale regions, are also given. Author

N72-19683# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
MIXING HEIGHTS, WIND SPEEDS, AND POTENTIAL FOR URBAN AIR POLLUTION THROUGHOUT THE CONTIGUOUS UNITED STATES
Jan. 1972 130 p refs
(AP-101) Avail: SOD $1.25

The mixing-layer height and the average wind speed within the mixing layer were calculated twice for each day of a 5-year record of upper air observations. A rough allowance was made for effects of the urban heat island on the morning mixing heights. The morning and afternoon times coincide approximately with those of maximum and secondary minimum concentrations of slow-reacting pollutants in cities. These calculations illustrate the typical large diurnal variation in atmospheric dispersion. A model of some general dispersion features over urban areas is described in which the normalized pollutant concentration averaged over a city is a function of mixing height, wind speed, and city size. The occurrence of episodes during which upper limits on mixing height and wind speed were not exceeded was determined. Isopleths are presented for mixing height, wind speeds, normalized pollutant concentrations that were exceeded, and total number of episode days for episodes lasting at least 2 and 5 days. Author

N72-19684# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
AIR POLLUTION ABSTRACTS, VOLUME 2, NO. 12 DECEMBER 1971
Dec. 1971 36 p refs
Avail: NTIS

Abstracts of technical literature recently accessioned by the Air Pollution Technical Information Center are presented. The areas of interest include emission sources; control and measurement; standards and criteria; atmospheric interactions; effects on human health, plants, livestock, and materials; and economic, legal, administrative, and social aspects. There are 714 entries. Author

N72-19685# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, JANUARY 1971
1971 303 p refs
Avail: NTIS HC $6.00/MF $0.95

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N72-19686# Environmental Protection Agency, Research Triangle Park, N.C.
COMPILATION OF AIR POLLUTANT EMISSION FACTORS
Feb. 1972 172 p refs Revised
(AP-42-Rev) Avail: SOD $1.50

Emission data are presented from source tests, material balance studies, engineering estimates, etc., for use by individuals and groups responsible for conducting air pollution emission inventories. The emission factors given cover most of the common emission categories: fuel combustion by stationary and mobile sources; combustion of solid wastes; evaporation of fuels; solvents, and other volatile substances; industrial processes; and miscellaneous sources. When no source test data are available, these factors can be used to estimate the quantities of primary pollutants (particulates, CO, SO2, NOx, and hydrocarbons) being released from a source or source group. Author

N72-19687# Royal Aircraft Establishment, Farnborough (England).
SPECIAL EVENTS OF METEOROLOGICAL ORIGIN (JANUARY 1966 TO NOVEMBER 1968) Civil Aircraft Airworthiness Data Recording Programme
G. E. King London Aeron. Res. Council 1971 38 p refs

Supersedes RAE-TR-70253; ARC-33163
(ARC-CP-1188; RAE-TR-70253; ARC-33163; CAADRP-TR-24)
Avail: NTIS; HMSO: 45p; PHI: $1.95

A small number of jet aircraft in normal airline service were fitted with recorders which produced continuous trace records of airworthiness data for 14 parameters. Throughout the recording period the records were searched for unusual occurrences, and each one was studied to determine its nature and; where possible, its cause. A selection of events of meteorological origin which were found in records taken between January 1966 and November 1968 is described. Author (ESRO)

N72-19688# Institut Royal Meteorologique de Belgique, Brussels.
THE WIND VELOCITY PEAKS IN BELGIUM [LES POINTES MAXIMALES DU VENT EN BELGIQUE]
R. Sneyers 1971 38 p refs In FRENCH *Its* Publ. Ser. A, No. 73
Avail: NTIS

Wind velocity maxima were recorded at Uccle (Belgium) from 1940 to 1969 and at other Belgian weather stations from 1958. Based on these data some statistical properties of the monthly, semiannual, and annual peaks were evidenced and the probability law governing the statistical distribution of the extreme values deduced. ESRO

N72-19689# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Dec. 1971 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, DECEMBRE 1971]
1971 17 p In FRENCH and DUTCH
Avail: NTIS

Meteorological parameters observed at different Belgian weather stations during December 1971 are given. ESRO

N72-19690# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION, SMOKE, AND SULFUR DIOXIDE Monthly Bulletin, Apr. 1971 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX BULLETIN MENSUEL, AVRIL 1971]
1971 28 p In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
Avail: NTIS

Data obtained at Belgian weather stations are tabulated. The air pollution apparatus is briefly described. ESRO

N72-19691# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Oct. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, OCTOBRE 1970]
1970 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in October 1970 are presented. ESRO

N72-19692# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Nov. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, NOVEMBRE 1970]
1970 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in November 1970 are presented. ESRO

N72-19693# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Dec. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, DECEMBRE 1970]
1970 32 p In FRENCH and DUTCH
Avail: NTIS

Synoptic measurements made at different Belgian weather stations in December 1970 are presented. ESRO

N72-19694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORECASTING THE VERTICAL VELOCITY
E. Titkos 18 Aug. 1971 12 p Transl. into ENGLISH from Idojaras (Budapest), 1968 p 346-349
(AD-733801; FTD-HC-23-817-71) Avail: NTIS CSCL 04/2

With the utilization of the vorticity equation and the basic equation of statics, a method has been developed for the computation of the vertical velocity occurring at the surface of pressure of 800 and 600 mb. Due to some regression equations it is, for the computation of vertical velocity, sufficient to have the values of the mean isobaric surface z and the thickness of the air layer situated below the mean isobaric surface.
Author (GRA)

N72-19695# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: SOUTHWEST ASIAN COASTAL MARINE AREAS. VOLUME 1, AREA 1, AKYAB; AREA 2, CALCUTTA; AREA 3, VISHAKHAPATNAM; AREA 4, MASULIPATAM
Dec. 1971 640 p refs
(AD-733692) Avail: NTIS HC $9.00/MF $0.95 CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The source was punched cards of weather observations taken aboard vessels of varying registry. The following areas are discussed: Akyab, Calcutta, Vishakhapatnam, Masulipatam. GRA

N72-19696# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: SOUTHWEST ASIAN COASTAL MARINE AREAS. VOLUME 5: AREA 17, KARACHI; AREA 18, SONMIANI; AREA 19, GWADAR; AREA 20, N. GULF OF OMAN
Dec. 1971 641 p
(AD-733693) Avail: NTIS HC $9.00/MF $0.95 CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The source was punched cards of weather observations taken aboard vessels of varying registry. The following areas are discussed in the report: Karachi(Pakistan); Sonmiani(Pakistan); Gwadar(Pakistan); Oman Gulf. Author (GRA)

N72-19697# Weather Wing (3rd), Offutt AFB, Nebr.
AN EXPERIMENT IN ADDITIONAL STRATIFICATION OF CONDITIONAL CLIMATOLOGY SUMMARIES FOR SHORT TERM FORECAST AIDS
Dale G. Rogers Nov. 1971 13 p refs
(AD-734036; Rept-3WW-TN-71-5) Avail: NTIS CSCL 04/2

The paper describes the results of an experiment to utilize two additional parameters in stratifying observational data for conditional climatology (CC) summaries. Conventional CC aids used throughout Air Weather Service stratify hourly observations by month, hour, initial ceiling/visibility category, and final ceiling/visibility category at some later time. Later versions add surface wind direction sectors as a fifth parameter. This note introduces the use of present weather and ceiling/visibility trend over the previous hour as the sixth and seventh variables in

determining the conditional probabilities of five ceiling/visibility categories four hours from initial observation. A sample of the output is presented. Author (GRA)

N72-19698# National Oceanic and Atmospheric Administration, Detroit, Mich. Lake Survey Center.
WINTER CLIMATOLOGY AND ICE CHARACTERISTICS: ST. MARYS RIVER-WHITEFISH BAY WATERWAY
Anthony J. Brazel Sep. 1971 67 p refs
(AD-733958; NOAA-TM-NOS-LSCR-3) Avail: NTIS CSCL 04/2

On a regional basis the thermal behavior of Lake Superior and its interaction with the atmosphere in late fall and early winter promote widely varying temperature and snowfall patterns around the lake periphery. Field investigations indicate that snow-ice layers make up a large portion of the total ice thickness at select sites around the lake and on the St. Marys River Waterway. On a local waterway scale for the St. Marys River, temperature controls on ice thicknesses and structures appear to be more significant at river sites where ice is more stable for a larger part of the ice season. Author (GRA)

N72-19699# New York Univ., N.Y. Geophysical Sciences Lab.
OPTIMAL PROBING OF THE ATMOSPHERE Final Report, 1 Apr. 1970 - 30 May 1971
Richard M. Schotland Ft. Monmouth, N. J. ECOM Dec. 1971 29 p ref
(Contract DAAB07-70-C-0142)
(AD-733885; GSL-TR-71-12; ECOM-0142-F) Avail: NTIS CSCL 04/2

An investigation has been performed of the fluctuations of cloud radiance at 5400 A as a function of cloud type and field of view of the receiving system. The fluctuations are observed to increase with nonuniformity of cloud structure and also with decreasing field of view. The ratio of the root mean square fluctuations of the cloud radiance to the mean value of the radiance was normally less than .005. Power spectra of the fluctuations are presented for cirrus, cumulus and altostratus cloud types. Author (GRA)

N72-19700# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
AN INVESTIGATION OF FLOW OVER HIGH ROUGHNESS. TASK 1: STUDY OF AIRFLOW IN SIMULATED TEMPERATE AND TROPICAL FOREST CANOPIES, FORT HUACHUCA
T. Kawatani and W. Z. Sadeh Aug. 1971 178 p refs
(Contracts DAAB07-68-C-0423; N00014-68-A-0493-0001; Proj. Themis)
(AD-734326; CER71-72TK-WZS3; ECOM-c-0423-10) Avail: NTIS CSCL 04/2

An experimental investigation of the atmospheric boundary-layer flow on high roughness was conducted by simulating the flow over a forest canopy in a meteorological wind tunnel. The model forest canopy used consisted of plastic simulated-evergreen trees. The measurements were carried out at constant free-stream velocity and under thermally neutral conditions. Two canopy densities were tested to explore the effects of the roughness density on the flow. Author (GRA)

N72-19701# Deutscher Wetterdienst, Hohenpeissenberg (West Germany). Meteorologisches Observatorium.
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AT THE HOHENPEISSENBERG METEOROLOGICAL OBSERVATORY Semiannual Report, Jan. - Jun. 1971
Walter Attmannspacher Aug. 1971 148 p
(Contract DAJA37-71-C-3347; DA Proj. 1T0-61102-B-53-A)
(AD-733523; SAR-1) Avail: NTIS CSCL 04/2

Ozone data, which was taken at different levels, are presented for frontal and storm passages at Hohenpeissenberg during the first half of 1971. The data were collected by ozonesondes. Author

N72-19702# Comar Space/Defense Corp., Birmingham, Mich.
DEVELOPMENT AND TEST OF A ROCKET LAUNCHED AUTOMATIC OCEAN UPPER AIR DATA ACQUISTION SYSTEM Final Report
Behram A. Irani 30 Sep. 1971 37 p refs
(Contract N00014-67-C-0479)
(AD-734177; TR-71-110) Avail: NTIS CSCL 04/2

A prototype system, called NOWEB, was developed and tested for the automatic acquisition of ocean upper air data by means of rocketsondes launched by the 2.75-inch FFAR (Folding Fin Aircraft Rocket) from a floating platform. The Navy's NOMAD Buoy was employed as the launch platform and the NOWEB subsystem permitted the modified NOMAD to acquire and transmit--automatically--meteorological surface data, ocean information and upper air data. Full scale system tests were conducted on Lake Superior followed by tests in the ocean environment at the Pacific Missile Range. Author (GRA)

N72-19703# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
FORT HUACHUCA, ARIZONA. CENTRAL METEOROLOGICAL OBSERVATORY Meteorological Data Report
Jan. 1971 41 p
(AD-729816) Avail: NTIS CSCL 04/2

Meteorological data are given for Fort Huachuca, Arizona, for the month of January, 1971. GRA

N72-19704# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
HUNTER-LIGGETT MILITARY RESERVATION, CALIFORNIA MILPITAS, Meteorological Data Report
Feb. 1971 97 p
(AD-730764) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at sites within the Hunter Liggett Military Reservation, California, during February 1971: Atmospheric precipitation; Atmospheric temperature; Atmospheric pressure; Humidity; Wind Author (GRA)

N72-19705# Naval Postgraduate School, Monterey, Calif.
FURTHER VERIFICATION OF AND EXPERIMENTS TO IMPROVE THE MODIFIED HATRACK FOR FORECASTING THE MOTION OF TROPICAL CYCLONES M.S. Thesis
Stephan Gregory Colgan Sep. 1971 57 p refs
(AD-734985) Avail: NTIS CSCL 04/2

The Modified Hatrack (MODHATR) scheme for forecasting tropical cyclone motion consists of a numerical steering component using geostrophic winds derived from Fleet Numerical Weather Central's SR height field to steer the storm center, and a statistical modification component to correct for bias and improve forecast accuracy. MODHATR forecasts from the 1969 and 1970 North Atlantic hurricane seasons are analyzed, and average errors presented and compared to earlier years' results. MODHATR forecasts are shown to be superior on the average to OFFICIAL forecasts, NHC-67, and TYRACK forecast schemes for forecast intervals to 48 hours, with relative accuracy of MODHATR decreasing with time. Author (GRA)

N72-19706# Naval Postgraduate School, Monterey, Calif.
SOME OBSERVATIONS ON THE STRUCTURE OF SHALLOW TYPHOONS M.S. Thesis
George Varga Sep. 1971 76 p refs
(AD-734978) Avail: NTIS CSCL 04/2

During the past few years the existence of tropical cyclones of typhoon intensity, but lacking the vertical extent of the classical model, have been reported. Five such shallow systems were investigated by compositing reconnaissance and rawinsonde data with respect to the center. Although emphasis was placed on POLLY (1968), a composite model was derived from the five storms. Some of the characteristics found in the model were the lack of convective activity, the existence of a warm core in the lower levels but very little warming aloft, and an open eyewall

rather than the closed eye found in classical typhoons. Some comparisons with the classical model are made but detailed reconnaissance data are needed to explain the differences between shallow and normal typhoons. Author (GRA)

N72-19707# Naval Postgraduate School, Monterey, Calif.
HARMONIC ANALYSIS OF SATELLITE SENSED TEMPERATURE ALONG LATITUDE OF BOTH HEMISPHERES FOR THE PERIOD 15 MAY - 28 JULY 1966 M.S. Thesis
John Jones Krall Sep. 1971 55 p refs
(AD-734975) Avail: NTIS CSCL 04/2

The object of the study is to examine the climatology of NIMBUS II satellite-sensed window-channel equivalent blackbody temperatures for the period 15 May to 28 July 1966. Fourier analysis was applied to these temperatures at selected latitudes in the Northern and Southern Hemispheres. The total variance, as well as the percentage contribution to variance by individual waves 1 through 8, along the selected latitudes is examined. In addition, correlation coefficients between adjacent key latitudes are computed and interpreted. Author (GRA)

N72-19708# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: SIBERIAN COASTAL MARINE AREAS. VOLUME 7: AREA 25, SOYA STRAIT E, AREA 26, URUP ISLAND, AREA 27, VLADIVOSTOK, AREA 28, OLGA
Dec. 1971 641 p
(AD-733998) Avail: NTIS HC $9.00/MF $0.95 CSCL 05/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. The collection of marine surface observations, a series of coastal marine summaries, includes Siberian Coastal marine areas Soya Strait E, Urup Island, Vladivostok and Olga. Author (GRA)

N72-19709# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 8: AREA 22, CENTRAL SEA OF JAPAN; AREA 23, SOUTHERN SEA OF JAPAN; AREA 24, WONSAN
Sep. 1971 483 p refs
(AD-733997) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of Marine Surface observations from which to develop a series of coastal Marine Summaries. The following areas are discussed in the report: Japan Sea; Wonsan(Korea). GRA

N72-19710# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
AIR POLLUTION CONTROL ACTIVE RESEARCH GRANTS FOR FISCAL YEAR 1971
Jul. 1971 59 p
(PB-204175; APTD-0740) Avail: NTIS CSCL 13B

A compilation of grant numbers, project titles and investigators, is presented for all research grants which were awarded during the fiscal year 1971, in the following major areas; human health effects; agricultural effects; socio-economic and political studies; physicochemical investigations, development of analytic methods and equipment; meteorology; air pollution source control; and communications. Author (GRA)

N72-19711# White Sands Missile Range, N.Mex. Atmospheric Sciences Lab.
CONTRIBUTIONS OF MATHEMATICAL TRANSFORMATIONS TO THE ERROR BEHAVIOR OF RAWINSONDE MEASUREMENTS
Walter B. Miller Aug. 1971 43 p refs
(DA Proj. 1T0-61102-B-53-A)
(AD-734819; ECOM-5404) Avail: NTIS CSCL 04/2

The effect of mathematical transformations on the error behavior of rawinsonde measurements is investigated by first considering range, azimuth, and height as supplied by the system as a continuous joint stochastic process of known mean and variance-covariance matrices. The transformation to a given rectangular cartesian coordinate system then gives rise in an obvious manner to a second joint stochastic process. The mean and variance-covariance matrices of this new process are approximated by matrices whose components are functions of the various components of the mean and variance-covariance matrices of the original process. The error behavior due to the mathematical transformation is defined as the behavior in time and space as described by the latter matrices. Author (GRA)

N72-19712# White Sands Missile Range, N.Mex.
TIME AND SPACE CORRELATION AND COHERENCE IN THE SURFACE BOUNDARY LAYER
Manuel Armendariz and Laurence J. Rider Sep. 1971 49 p refs
(DA Proj. 1T0-61102-B-53-A-17)
(AD-734820; ECOM-5407) Avail: NTIS CSCL 04/2

Wind component correlation and coherence at 1.5, 4.0, and 16.0 meters are presented as a function of horizontal distance, vertical separation of the sensors, lag time, and sensor line orientation with respect to mean wind, under stable and unstable atmospheric conditions. The results indicate that vertical correlation is dependent not only on the vertical distance between sensors but also on the absolute height of the instruments above ground. Author (GRA)

N72-19713# Weather Squadron (24th), Columbus AFB, Miss. Detachment 02.
TERMINAL FORECAST REFERENCE FILE, COLUMBUS AIR FORCE BASE, MISSISSIPPI Final Report
1 Nov. 1971 52 p refs
(AD-734807) Avail: NTIS CSCL 04/2

The reference file discusses factors affecting the weather at Columbus AFB, Mississippi. Included are location and topography, weather controls, climatic aids, and local forecast studies. Author (GRA)

N72-19714# Weather Squadron (17th), McClellan AFB, Calif. Detachment 08.
TERMINAL FORECAST REFERENCE FILE FOR McCLELLAN AIR FORCE BASE, CALIFORNIA
18 Oct. 1971 59 p
(AD-734800) Avail: NTIS CSCL 04/2

The reference file discusses factors affecting the Weather at McClellan AFB, California. Included are location and topography, weather controls, climatic aids, and local forecast studies. Author (GRA)

N72-19715# Texas A&M Research Foundation, College Station.
EVALUATION OF ATMOSPHERIC TRANSPORT AND DIFFUSION Semiannual Report, 15 Dec. 1970 - 15 Jun. 1971
Tom E. Sanford Jul. 1971 40 p
(Contract DAAB07-68-C-0381; DA Proj. 1T0-62111-A-12605; A/M Proj. 586)
(AD-734929; A/M-Ref-71-15T; ECOM-0381-6; SAR-6) Avail: NTIS CSCL 04/2

The initially scaled equations for mean transport and vertical diffusion of trace elements for the one-dimensional mathematical model of a tropical forest are included in the report along with the wiring diagrams required for solution. In addition, the manner of calculating the setting of each potentiometer and a procedure for determining the voltages necessary for checking the patchboard circuitry at the initial time for a given period of simulation are presented. Author (GRA)

N72-19716# Naval Postgraduate School, Monterey, Calif.
SOME DESIGN EXPERIMENTS TOWARD AN OPERATIONAL PRIMITIVE EQUATION MODEL FOR THE TROPICS M.S. Thesis
Charles George Steinbruck Sep. 1971 54 p refs
(AD-734868) Avail: NTIS CSCL 04/2

A barotropic and two- and three-layer baroclinic primitive equation prediction models are developed from a ten-layer model previously designed for short range forecasts in the tropics. Twenty-four predictions from the models are compared to evaluate any degradation in the forecasts as the vertical resolution of the models decreases. The barotropic primitive equation model on a global tropical grid is used to evaluate the possibility of using a numerical variational analysis as an initialization technique. Initialization of data with the nonlinear balance equation is used as a comparison. Author (GRA)

N72-19373# National Center for Atmospheric Research, Boulder, Colo.
NUMERICAL CLOUD MODELS
R. L. Drake *In its* Particulate Models: Their Validity and Appl. Aug. 1971 p 175-177 (See N72-19357 10-13)
Avail: NTIS

N72-19374# Denver Univ., Colo.
CLOUD PHYSICS STUDIES AT THE DENVER RESEARCH INSTITUTE
N. Fukuta *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 179-183 refs (See N72-19357 10-13)
Avail: NTIS

N72-19376# Air Force Cambridge Research Labs., Bedford, Mass.
DROP SIZE MEASUREMENTS IN LOW-LEVEL STRATUS
J. E. A. Selby *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 191-196 refs (See N72-19357 10-13)
Avail: NTIS

N72-19383# Environmental Protection Agency, Research Triangle Park, N.C. Region 8 Office.
SURVEY OF AIRBORNE POLLUTANTS
Norman A. Huey *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 25-60 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

N72-19392# Environmental Protection Agency, Research Triangle Park, N.C. National Environmental Research Center.
METEOROLOGY AND SOURCE-RECEPTOR RELATIONSHIPS
Paul Humphrey *In its* Helena Valley, Mont., Area Environ. Pollution Study Jan. 1972 p 161-179 refs (See N72-19381 10-13)
Avail: NTIS; Office of Tech. Inform. and Publ., Office of Air Programs, Environ. Protection Agency, Res. Triangle Park, N.C. 27711

N72-19421# Air Force Cambridge Research Labs., Bedford, Mass.
STATISTICAL METHODS OF INDIRECT PROBING OF THE ATMOSPHERE
V. Falcone, Jr. and K. Mano *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 5 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-19717*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
A STELLAR TRACKING REFERENCE SYSTEM Final Report, 15 Jun. 1970 - 15 Jun. 1971
B. Klestadt Jun. 1971 357 p
(Contract NAS5-21508)
(NASA-CR-119676; SCG-10307R) Avail: NTIS HC $6.00/MF $0.95 CSCL 17G

A stellar attitude reference system concept for satellites was studied which promises to permit continuous precision pointing of payloads with accuracies of 0.001 degree without the use of gyroscopes. It is accomplished with the use of a single, clustered star tracker assembly mounted on a non-orthogonal, two gimbal mechanism, driven so as to unwind satellite orbital and orbit precession rates. A set of eight stars was found which assures the presence of an adequate inertial reference on a continuous basis in an arbitrary orbit. Acquisition and operational considerations were investigated and inherent reference redundancy/reliability was established. Preliminary designs for the gimbal mechanism, its servo drive, and the star tracker cluster with its associated signal processing were developed for a baseline sun-synchronous, noon-midnight orbit. The functions required of the onboard computer were determined and the equations to be solved were found. In addition detailed error analyses were carried out, based on structural, thermal and other operational considerations. Author

N72-19718*# Litchford Systems, Northport, N.Y.
BROADCAST CONTROL OF AIR TRAFFIC Quarterly Progress Report
G. Litchford Dec. 1971 45 p refs
(Contract NASw-2247)
(NASA-CR-125807; QPR-2) Avail: NTIS CSCL 17G

The proceedings of a conference on the Omega navigation system are presented. Three significant low frequency/very low frequency possibilities are considered as follows: (1) use of Worldwide (WW) Omega, (2) use of an Omega-like system optimized for aviation in the continental United States, (3) a mix use of WW Omega and Vor, U.S. Omega and VOR, and U.S./WW Omega. It is concluded that all possibilites can be tested with current plans for WW Omega. Author

N72-19719# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ATC/CAS INTERFACE SIMULATION, EXPLORATORY PHASE Interim Report, Mar. - Jul. 1971
Gordon Jolitz Mar. 1972 166 p
(Proj. 052-241-03Y)
(FAA-RD-72-10; FAA-NA-72-8) Avail: NTIS

A dynamic simulation was conducted to explore the nature of the interaction between the air traffic control (ATC) system and a collision avoidance system (CAS). The simulated ATC environment was a high density terminal area which provided for simultaneous approaches to parallel runways. The CAS threat logic was modeled after a design which was developed by a technical working group under the auspices of the Air Transport Association. Threat evaluation and maneuver output of the CAS were based on measured range, range rate and altitude difference. The objective was to study the characteristics of ATC/CAS interaction as a function (a) of the location of the Cas switchpoint from full system threat evaluation to landing mode; and (b) variations in controller technique. Author

N72-19720# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF A PORTABLE SCANNING BEAM GUIDANCE SYSTEM Final Report, Oct. 1968 - Jun. 1970
Vincent L. Bencivenga Mar. 1972 112 p
(Proj. 074-319-03Y)
(FAA-RD-72-26; FAA-RD-72-16; FAA-NA-72-26) Avail: NTIS

A portable scanning beam guidance system was installed and tested at 28 field locations. The sites selected were located at 16 different airports in the Eastern United States and were known to be difficult instrument landing system (ILS) sites. The system was tested both as a glide slope and as a localizer. During these tests, the guidance equipment was not affected by terrain irregularities, taxiing aircraft, vehicle movement, buildings adjacent to the airfield, etc. The system was installed, calibrated, and initially aligned without the need for extensive flight testing to verify system performance. Author

N72-19721*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERMINATION OF ANGLES OF ATTACK AND SIDESLIP FROM RADAR DATA AND A ROLL-STABILIZED PLATFORM
John S. Preisser Washington Mar. 1972 22 p refs
(NASA-TM-X-2514; L-7886) Avail: NTIS CSCL 17G

Equations for angles of attack and sideslip relative to both a rolling and nonrolling body axis system are derived for a flight vehicle for which radar and gyroscopic attitude data are available. The method is limited to application where a flat, nonrotating earth may be assumed. The gyro measures attitude relative to an inertial reference in an Euler angle sequence. In particular, a pitch, yaw, and roll sequence is used as an example in the derivation. Sample calculations based on flight data are presented to illustrate the method. Results obtained with the present gyro method are compared with another technique that uses onboard camera data. Author

N72-19722# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
POTENTIAL ECONOMIC BENEFITS OF FOG DISPERSAL IN THE TERMINAL AREA. PART 1: ESTIMATING PROCEDURE Final Report
Nov. 1971 225 p
(FAA Proj. RD-260-001-01R)
(AD-735132; FAA-RD-71-44-1-Pt-1) Avail: NTIS CSCL 17/7

The study was designed to provide estimates of the costs of disruptions (delays, diversions, and cancellations) of aircraft arrivals (landings) associated with a number of Category II and III weather situations, with the emphasis on fog situations, at some of the major air carrier airports in the United States. As such they would be measures of the potential economic benefits the airport users would realize if the adverse effects of these weather situations on aircraft landings were completely eliminated by weather modification and/or electronic and other approach and landing aids. This part of the report consists of the introduction to the report and a narrative description of the estimating procedure, together with some of supporting statistical material developed in connection with the estimating process.
Author (GRA)

N72-19723# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
STUDY OF A SYSTEM USING ON-OFF ACTUATORS TO CONTROL THE SPIN AXIS ORIENTATION OF A SPINNING SATELLITE [ETUDE D'UN SYSTEME DE PILOTAGE AVEC COMMANDES PLUS OU MOINS POUR L'ORIENTATION DE L'AXE DE ROTATION D'UN SATELLITE GYROS COPIQUE]
Alain Liegeois Oct. 1971 38 p refs In FRENCH; ENGLISH summary
(LAAS-NI-AC-71-I-01) Avail: NTIS

The laws proposed for the attitude control of a spinning satellite are such that the spin axis can be brought to the vicinity of the given reference direction (sporadic reorientations) and be maintained there when a quasi-permanent stabilization is necessary. The controls are of the on-off type, allowing conventional body-fixed actuators (cold gas jets for example) to be used. The control signals are shaped by very simple analog circuitry. The system works in a closed-loop manner. Both a fast transient response and a small steady-state error are obtained by varying a single parameter of the controller; the actuators only work when favorable fuel economy conditions are present. Simulation results confirm these properties and give a guide for the design of similar control systems. Author (ESRO)

N72-19724# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A DYNAMIC SIMULATION STUDY OF AIR TRAFFIC CAPACITY IN THE SAN FRANCISCO BAY TERMINAL AREA Final Report, Feb. - Sep. 1970
Paul J. OBrien Aug. 1971 114 p ref
(FAA Proj. 154-005-01)
(AD-727756; FAA-NA-71-20; FAA-RD-71-37) Avail: NTIS CSCL 01/2

A dynamic simulation of air traffic operations in the San Francisco Bay terminal area was conducted to determine air traffic capacity estimates when several different airport expansion plans were implemented. Capacity estimates were made for the following separate conditions: first, the present day system slightly modified to accommodate an increased volume of traffic; second, with the operation of an additional runway at San Francisco Airport; third, with the operation of an additional runway at Oakland Airport; and fourth, with the operation of a new multiparallel runway airport located near the south end of San Francisco Bay and without the expansion to either San Francisco or Oakland Airports. An estimate was also made of the total system capacity when all airport expansions were implemented. Author (GRA)

N72-19725# Army Land Warfare Lab., Aberdeen Proving Ground, Md.
SITE MARKER BEACON SYSTEM Final Report
Curtis L. Paxton Jun. 1971 18 p refs
(LWL Proj. 05-E-67)
(AD-733916; TR-71-09) Avail: NTIS CSCL 17/7

The report covers the development and test of a VHF radio beacon system designed for use as a marker of friendly locations from under the dense jungle canopy. In order to minimize the amount of development required, the design factors of the beacon system were made compatible with the ARC-54 aircraft radio equipment and its associated homing equipment.
Author (GRA)

N72-19726# Airborne Instruments Lab., Deer Park, N.Y.
MICROWAVE GLIDE SLOPE SYSTEM ENGINEERING MODEL Final Report
C. J. Creedon Jun. 1971 47 p
(Contract DOT-FA67WA-1745)
(AD-733694; FAA-RD-71-41; Rept-2472-1) Avail: NTIS CSCL 17/7

The development of an L-band, 1585-MHz glide slope system is described, complete with monitoring capability, that is fully compatible with the existing UHF glide slope system. It was necessary to develop and fabricate two slotted waveguide antennas (24 and 32 feet), solid state transmitter/modulator components, an aircraft frequency converter, and an antenna unit. This system was tested and found to have good course quality with each of the antennas. However, the 32 foot antenna was best suited to the lower glide slope angles of 2.5 to 2.7 degrees and the 24-foot antenna for the 2.7 to 3.0 degree path angles, in terms of below path clearance. Author (GRA)

N72-19727# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HOMING GUIDANCE SYSTEMS

E. I. Krinetskii 1 Oct. 1971 272 p refs Transl. into ENGLISH of the book "Sistemy Samonavedeniya" Moscow, Izd-vo Mashinostroyeniye, 1970 p 1-235
(AD-734520; FTD-MT-24-1059-71) Avail: NTIS CSCL 17/7

Questions of designing homing guidance systems of aerodynamically guided rockets of various classes are examined in this book. The equation of the ideal homing guidance method, ensuring rocket flight to an actual point of contact with a maneuvering target, is herein presented. It is also shown that other known homing guidance methods are realizations of the ideal method with limited information about the motion of the rocket and the target. Author (GRA)

N72-19728# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALGORITHM AND GENERAL PRINCIPLES OF INFORMATION PROCESSING IN A CIVIL AVIATION TRAFFIC SYSTEM
M. Libura and S. Walukiewicz 18 Oct. 1971 25 p refs Transl. into ENGLISH from Polska Akad. Nauk, Inst. Automatyki, Prace (Poland), no. 83, 1969 p 1-25
(AD-734881; FTD-HC-23-953-71) Avail: NTIS CSCL 17/7

A description is given of steps involved in flight planning and control of flight plan completion required for a complete air traffic control system at airports. The proposed concept of flight control automation is characterized by the use of a closed Air Traffic ATC System, where ATC has feedback on control quality which allows the introduction of changes required with time. The study features mathematical descriptions which can serve as a basis for detailed theoretical and practical investigations. Author (GRA)

N72-19729# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INERTIAL NAVIGATION SYSTEMS
I. A. Gorenshtein and I. A. Shulman 6 Oct. 1971 227 p refs Transl. into ENGLISH from the book "Inertsyalnyye Navigatsionnye Sistemy" 1970 p 1-164
(Contract F33657-71-D-0057; AF Proj. 605020)
(AD-734630; FTD-HC-23-327-71) Avail: NTIS CSCL 17/7

The book presents the theoretical principles underlying inertial navigation and describes the basic functional elements of inertial navigation systems (INS). General and specific representations of the algorithm for determining the running coordinates of an object are examined as applied to certain practically important methods of construction INS, their classification, analysis of errors, preparation for operation, and also problems of protecting INS from external sources. Author (GRA)

N72-19730# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INTERMEDIATE ACTIVITY LEVEL TOWER CAB EVALUATION, PHASE 2 Final Report, Jul. - Sep. 1971
J. Roy Bradley, Jr. Dec. 1971 49 p
(FAA Proj. 144-170-06X)
(AD-735131; FAA-NA-72-2; FAA-RD-7-104) Avail: NTIS CSCL 17/7

The project was conducted to determine Air Traffic Controllers acceptance of an intermediate activity level airport traffic control tower, proposed for construction on a national basis, and to obtain suggestions for improving the proposed facility. Full-scale mockups of the tower cab and associated junction room were constructed and equipped with operational equipments at the National Aviation Facilities Experimental Center, Atlantic City, New Jersey. A 2-week evaluation was conducted with participation by air traffic control specialists from each of the 11 Federal Aviation Administration regions. Results indicate that the proposed tower would be highly acceptable from an operational, as well as an environmental standpoint. Author (GRA)

N72-19731# Center for Naval Analyses, Arlington, Va. Systems Evaluation Group.
POSITION FINDING WITH EMPIRICAL PRIOR KNOWLEDGE
Peter J. Butterly Nov. 1971 22 p refs
(Contract N00014-68-A-0091)
(AD-735112; SEG-Research-Contrib-197) Avail: NTIS CSCL 17/3

Information on the position of a source of radiation is often obtained from bearing observations made from two or more known locations. Some criticisms of existing procedures are enumerated and a new approach proposed. This approach allows for the incorporation of knowledge existing before the observations are made and provides simple computational procedures for estimating the source position and for ascertaining the new state of knowledge from the data furnished by the observations. Author (GRA)

N72-19495# Marconi Space and Defence Systems, Ltd., Frimley (England).
METHODS OF IDENTIFICATION OF THE EARTHS HORIZON AND EXAMPLES OF APPLICATION TO ATTITUDE DETERMINATION OF SPACECRAFT
G. G. Fuller and M. L. Reynolds *In* AGARD Avionics in Spacecraft Sep. 1971 9 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-19732*# Scientific Translation Service, Santa Barbara, Calif.
NONDESTRUCTIVE DETERMINATION OF AVERAGE BURNUP FOR IRRADIATED FUEL RODS
T. Hiroshi and A. Mamoru Washington NASA Mar. 1972 14 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Toyko), v. 13, no. 7, 1971 p 374-379
(Contract NASw-2035)
(NASA-TT-F-14201) Avail: NTIS CSCL 18J

A nondestructive measurement on avererage burnup of irradiated fuel rods with use of Ge(Li) detector is described. In order to obtain the average burnup directly and to simplify measurement and analysis, the gamma-ray spectrum from the irradiated fuel rod was measured by scanning along the whole length of the rod. The total absorption peaks for the 0.662 MeV (Cs-137) and the 2.18 MeV (Pr-144) gamma-rays were used in the analysis, and the peak areas were estimated by Covell's method. The absolute value of average burnup was determined by comparison of the peak area with that of a standard fuel rod. The accuracy of the nondestructive measurement is discussed on the basis of an accurate value from destructive analysis. The results shows that it is possible to give the average burnup with good accuracy when the ratio of the peak height for Cs 137 to the Compton background is larger than about 1.5, that is after about 1 year of cooling. Author

N72-19733# Sandia Labs., Albuquerque, N.Mex. Reentry and Space Sciences Div.
THERMAL DESIGN AND ANALYSIS OF THE APOLLO LUNAR RADIOISOTOPIC HEATER
Robert D. Klett Sep. 1971 54 p refs Sponsored by AEC
(SC-RR-71-0533) Avail: NTIS

The reentry thermal analysis of the Apollo lunar radioisotopic heater for a random tumbling and spinning motion with a surface averaged heat flux is reported. Orbital decay and lunar

returns with reentry angles ranging from minus 6.25 deg to minus 90 deg were analyzed. The temperatures of the heater in a launch pad abort fire were also predicted. The study of the original design led to several recommendations for modifications which were incorporated in the final heater configuration.
Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-19734*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ION BOMBARDMENT AND ITS EFFECTS ON THE OPTICAL PROPERTIES OF METALS
Donald L. Anderson [1964] 20 p refs
(NASA-TM-X-67660) Avail: NTIS CSCL 20F

An experimental program, to evaluate the change in total hemispherical emittance and solar absorptance of engineering metals used on spacecraft and in spacecraft instrumentation systems, is presented. Three materials, titanium alloy, pure aluminum, and electrolytic copper, were used in the experiment. Results show that emittance, absorptance, and alpha/epsilon ratio of the materials were changed by ion bombardment. The time before the change occurs depends upon the material used, the intensity of bombardment, and the environment assumed.
E.H.W.

N72-19735*# Techtran Corp., Glen Burnie, Md.
PHYSICAL EXPERIMENTS WITH TEST BODIES
V. B. Braginskiy Washington NASA Feb. 1972 128 p refs Transl. into ENGLISH of "Fiz. Eksperim. Probnymi Telami" Moscow, Nauka Press, 1970
(Contract NASw-2037)
(NASA-TT-F-672) Avail: NTIS CSCL 20K

Physical experiments are examined in which the detection of an effect essentially involves the detection of a small force or moment of force acting on a macroscopic body. The threshold response of a mechanical oscillator to a regular external force is analyzed. The effects of light friction and radiometric oscillatory instability are studied. Estimates of the minimum detectable magnetic field strengths, electric charge, acceleration, etc., are given. Experiments for checking the equivalence principle, for searching for elementary particles with a fractional electric charge, and for detecting quantum macroscopic effects are considered. The prospects for detecting gravitational radiation and carrying out relativistic gravitational experiments in the nonwave zone are evaluated. The limiting attainable responses in the search for relict quarks with a whole electric charge and electric dipole moments of elementary particles are examined. Methods are described for measuring small mechanical displacements and mechanical fluctuations in a space laboratory.
Author

N72-19736*# Scientific Translation Service, Santa Barbara, Calif.
STUDIES ON THE STABILIZATION OF ATOMIC HYDROGEN BY MEANS OF LOW TEMPERATURES AND STRONG MAGNETIC FIELDS Ph.D. Thesis
R. Hess Washington NASA Mar. 1972 115 p refs Transl. into ENGLISH of "Untersuchungen ueber die Stabilisierung von atomarem Wasserstoff mit Hilfe tiefer Temperaturen und starker magnetischer Felder", Stuttgart Univ. Ph.D. Thesis, 1971 p 1-124
(Contract NASw-2035)
(NASA-TT-F-14123) Avail: NTIS CSCL 20L

Theoretical considerations on the hydrogen molecule suggest the possibility of stabilizing hydrogen in the nascent state, which can be prevented from recombining to molecular hydrogen by the use of very high magnetic fields at extremely low ambient temperatures. From the quantum theory of paramagnetism, the magnetic field can be given strength required for spin stabilization of atomic hydrogen as a function of the temperature. The question of the possible configuration with larger ensembles at higher density is raised by means of a modified metal formulation and specific gas considerations. A strict solution of the problem was not attempted, as the physical properties would have had to be known. The main efforts were directed at experimentation. For this, it was necessary to dissociate molecular hydrogen at the lowest possible temperature, cool it in a high magnetic field of at least 50,000 - 60,000 Gauss, and stabilize it at temperatures below 1.5 K. The experimental system consequently required the application of cryogenic techniques and superconductivity.
Author

N72-19737*# Scientific Translation Service, Santa Barbara, Calif.
ACOUSTIC INTERFERENCE BY REFLECTION APPLICATION TO THE SOUND PRESSURE SPECTRUM OF JETS
P. Thomas NASA Washington Mar. 1972 37 p refs Transl. into ENGLISH of the publ. "Etude des interferences acoustiques par reflexin. Application aux spectres de pression acoustique desjets" Paris, SNECMA, May 1969 p 1-20
(Contract NASw-2035)
(NASA-TT-F-14185) Avail: NTIS CSCL 20/1

Theoretical and experimental studies of the interfering reflection phenomena which distort acoustic measurements and some fundamental relations for developing applicable correction factors were evaluated. Two hypotheses were examined: that of white noise, and that of the actual source. Each was found to be valid in describing jet noise distribution characteristics assuming a perfectly reflecting surface. The phenomena of interferences are altered when the jet is near the surface and under certain sustained generator conditions.
Author

N72-19738# Research Inst. of National Defence, Stockholm (Sweden). Physics Dept.
AXIALLY SYMMETRIC AIR-CORE COILS WITH HOMOGENEOUS AND STRONG MAGNETIC FIELD
Evald vonZeipel Jan. 1972 20 p refs
(FOA-2-B-2031-E1; FOA-Vol-6-No-1) Avail: NTIS

The construction of coils is considered and figures and tables are presented, giving predetermined dimensions and properties. An integral formula for Legendre polynomials is given in connection with coil theory. The formula yields directly integrated analytic expressions concerning field intensity and inhomogeneity for circularly cylindric coils with a layer of thin windings. Expressions were obtained for the fields of thick coils with conical end surfaces, by direct radial integration of the expressions for thin coils. The treatment of axially symmetric coils is two-dimensional, with the axis of symmetry as the z axis and an equatorial radius as the y axis. The winding cross section lies in the yz plane and consists of a geometric figure within which the perpendicularly cut winding wires are situated. K.P.D.

N72-19739*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REFLECTION AND TRANSMISSION OF ACOUSTIC WAVES FROM A MOVING LAYER
George G. Steinmetz and Jag J. Singh Washington Mar. 1972 23 p refs
(NASA-TN-D-6673; L-8133) Avail: NTIS CSCL 20A

The refraction of acoustic waves by a moving medium layer is theoretically treated and the expressions for reflection and transmission coefficients are determined. The moving medium layer velocity is assumed to have a space dependence in one direction. A partitioning of the moving medium layer into constant-velocity sublayers is introduced and the number of sublayers is allowed to increase until the reflection and

transmission coefficients converage to their respective values. Numerical results for several sublayer approximations of Poiseuille's flow are presented as functions of the moving layer velocity for several angles of incidence of the acoustic wave. The degenerate case of single constant-velocity layer is also treated, both theoretically and by a numerical analysis. Author

N72-19740# Pennsylvania Univ., Philadelphia. Towne School of Civil and Mechanical Engineering.

CONTINUUM ELECTROSTATIC PROBE THEORY WITH MAGNETIC FIELD

Kalyan K. Niyogi and Ira M. Cohen Jan. 1972 41 p refs
(Grants NSF GK-1652; NSF GK-2281)
(Rept-2281/5) Avail: NTIS

A continuum electrostatic probe theory is developed for a slightly ionized, collision-dominated plasma in presence of a uniform magnetic field. A quasi-linearization technique is applied to solve the nonlinear equations numerically using finite difference approximations, in the case of spherical probes larger than at Debye length, the magnetic field being weak. The sheath equations are essentially one-dimensional and the magnetic field parameters do not appear explicitly. In the absence of an analytic solution for either sheath or the main region, both solutions are matched numerically in an overlap region. The effect of magnetic field on the nature of the distribution of the charged particles and the potential in space and on the probe surface is investigated in detail. The phenomenon of potential overshoot in the case of a probe biased near plasma potential, is clearly revealed. The accuracy of the usual assumption that the ions and the electrons follow a Boltzmann distribution even in the presence of magentic field for large positive and negative probe potentials respectively, is investigated. A few representative current-voltage characteristics at various magentic fields are drawn. A systematic procedure for the interpretation of the probe characteristics is developed. Author

N72-19741*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A METHOD FOR REDUCING GROUND REFLECTION EFFECTS FROM ACOUSTIC MEASUREMENTS

Jere A. Noerager, Edward J. Rice, and Charles E. Feiler Washington Mar. 1972 69 p refs
(NASA-TN-D-6666; E-6573) Avail: NTIS CSCL 20A

The method involved placing foam blocks on the ground between sound source and receiver in an approximation of the wedges in an anechoic chamber. The tests were performed out of doors as a function of the receiver height and source-receiver separation distance. The spacing between blocks and the extent of ground covered were varied to estimate the optimum placement and minimum amount of foam treatment needed. Base-line tests without foam were also performed. It was found that the foam treatment reduced the amplitude of the peaks and valleys in the sound pressure spectra substantially. The foam was least effective at low frequency, especially for the low receiver height and for large source-receiver distances. Results from the base-line tests were compared with theoretically predicted results. These base-line test results were in reasonable agreement with those from theory. Author

N72-19742# Bristol Univ. (England).

NOTES ON THE DIFFRACTION OF SOUND

J. C. Cooke London Aeron. Res. Council 1971 27 p refs Supersedes RAE-TR-69283; ARC-32130
(ARC-CP-1192; RAE-TR-69283; ARC-32130) Avail: NTIS; HMSO: 45p; PHI: $1.95

Two problems involving sound diffraction in a semi-infinite plane with an adjacent source are considered. The problems involve the system at rest and the system in motion through the fluid either with a stationary or moving observer. Asymtotic forms are given for large wave number and for the observer in the far field. Author (ESRO)

N72-19743# Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.

CURVATURE EFFECTS IN THE DIFFRACTION OF SHORT WAVES INTO A SHADOW

F. G. Leppington London Aeron. Res. Council 1971 44 p refs Supersedes RAE-TR-70183; ARC-32505
(ARC-CP-1193; RAE-TR-70183; ARC-32505) Avail: NTIS; HMSO: 77p; PHI: $3.35

The distant field within the shadow cast by a point source in the presence of a semiinfinite rigid plane is compared with that for a rounded body. Within the deep shadow region, not too close to the shadow boundary, it is found that the field is much less for the rounded obstacle in the short wave limit, having exponentially small behaviour compared with the algebraic decay appropriate to the half-plane case. At points very close to the geometrical shadow boundary, on the other hand, the pressure field exhibits almost identical behavior for each geometry, this being the familiar Fresnel pattern, but with a change of phase for the rounded body. Consideration is given to the possibility of choosing the shape of a rounded obstacle, within certain overall restrictions, in order to minimize the diffracted field within the deep shadow region. Author (ESRO)

N72-19744# Rome Univ. (Italy).

LOW FIELD DEPENDENCE OF SUSCEPTIBILITY MAXIMUM IN ANTIFERROMAGNETIC $MnCl_2$-4H_2O

M. Cerdonio and P. Paroli (CNR, Rome) 23 Jul. 1971 8 p refs Sponsored jointly by GNSM and CNR
(Nota-Interna-330) Avail: NTIS

Previous experiments and theories of antiferromagnetic materials showed that the temperature of the susceptibility maximum in a small field H should be significantly higher than the Neel temperature. At very low H an unexpected dependence of the temperature of the susceptibility maximum upon H in $MnCl_2$-4H_2O is found, approaching the Neel temperature at zero field and the previous results at higher fields. Author (ESRO)

N72-19745# California Univ., Los Angeles. School of Engineering and Applied Science.

GUIDED WAVES ALONG NON-CIRCULAR FIBERS

C. Yeh Oct. 1971 73 p refs
(Contract N00014-69-A-0200-4026)
(AD-734015; UCLA-ENG-7175) Avail: NTIS CSCL 20/6

The advent of integrated optics and the availability of low-loss fibers prompted a renewed urgency in the understanding of the guiding properties of optical fibers. The present presentation is concerned with the propagation characteristics of waves along a non-circular fiber. Three analytical methods in treating this problem will be discussed; one on the exact solution of modes on elliptical fiber, the other on the numerical solution of modes on rectangular fiber and the third on the approximate solution of modes on complex structure of rectangular fibers. Significant differences between guided modes along a circular fiber and those along a flattened fiber are discussed in detail. Theoretical results on dominant modes have also been verified by experiments at microwave frequencies. Author (GRA)

N72-19746# Naval Research Lab., Washington, D.C. Underwater Sound Reference Div.

SPEED OF SOUND IN FOUR ELASTOMERS Interim Report

J. L. Lastinger and I. D. Groves, Jr. 3 Dec. 1971 13 p refs
(SF-11-121-302-14083)
(AD-733978; NRL-MR-2363) Avail: NTIS CSCL 11/10

Elastomer compounds are widely used in the construction of underwater electroacoustic transducers. The speed of sound in these compounds, and other physical properties as well, can differ over a wide range, depending not only on the ingredients in the compounds but also on curing time, curing temperature, and other factors. Measurements made at 5-7 kHz on four elastomer compounds provide sound speed values as a function of both temperature (5-40C) and hydrostatic pressure (atm to 10,000 psi). Author (GRA)

N72-19747# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTITUTE OF THEORETICAL AND EXPERIMENTAL PHYSICS (SELECTED ARTICLES)
V. V. Miller 17 Sep. 1971 36 p refs Transl. into ENGLISH of the book "Institut Teoreticheskoya i Eksperimentalnoi Fiziki" Moscow, 1969 p 1-32
(FTD Proj. 7JJ)
(AD-734227; FTD-MT-24-877-71) Avail: NTIS CSCL 20/7

Magnetic systems with compensating magnet, transferred to the end of the channel are analyzed. The linear dispersion is compensated at the position of final image and at the center of that lens of the exist doublet, in which the beam has maximum horizontal spread. As for usual achromatic system; for these almost Achromatic systems a good transmission for given wide band can be achieved. With focusing orders DFFFD and FDFDF the deflection angles in compensating magnet differ by factor of 3-4. In some cases this feature permits having two zero dispersion beams at the end of the system, and switching the beam from one experimental site to another. Alternatively, one can have beams with compensated or enlarged dispersion without loss of the intensity. Author (GRA)

N72-19748# Ohio State Univ., Columbus. Electroscience Lab.
INVESTIGATION OF 10.6 MICRON PROPAGATION PHENOMENA Quarterly Report, 8 Jul. - 8 Oct. 1971
William G. Swarner 8 Oct. 1971 20 p refs
(Contract F30602-70-C-0003; APRA Order 1279)
(AD-734074; ESR-2880-5; RADC-TR-71-286) Avail: NTIS CSCL 20/6

Progress is reported on the construction and testing of apparatus and the development of computer software for experiments in imaging and image restoration at 10.6 microns. The initial experiment involves recording, in digital format, the atmospherically degraded images of a pair of point sources with subsequent computer processing for image restoration and determination of isoplanatic patch size for various atmospheric conditions. Recent additions to the experimental equipment are described and samples of images recorded and reproduced via the Miller code digital magnetic tape recording system are presented. Author (GRA)

N72-19749# Naval Ordnance Lab., White Oak, Md.
SOURCE LEVELS OF SHALLOW UNDERWATER EXPLOSIONS
Joel B. Gaspin and Verna K. Shuler 13 Oct. 1971 57 p refs
(ONR Proj. R2408)
(AD-734381; NOLTR-71-160) Avail: NTIS CSCL 20/1

A method of estimating source energy levels for shallow underwater explosions used as acoustic sources is developed. The method uses idealized quasi-theoretical pressure-time records and digital processing techniques. The need for such a method of estimating source levels is discussed in light of the fact that when the direct arrival pressure pulse is not time-separable from the surface-reflected arrival, no direct measurement of source level is possible. Author (GRA)

N72-19750# Admiralty Research Lab., Teddington (England).
INTERFERENCE OF WIDE-BAND SOUND IN SHALLOW WATER
D. E. Weston and K. J. Stevens Feb. 1971 18 p refs
(AD-733199; ARL/L/R89; TRC-BR-26813) Avail: NTIS CSCL 20/1

Propagation experiments are described covering ranges of several km and frequencies between 0.1 and 1.2k Hz. The interference pattern for a source towed past a hydrophone demonstrates a focussing effect predicted theoretically. The interference pattern for a fixed source shows tidal changes of a magnitude agreeing with theory. From the results of both experiments the number of modes effective is found to vary as (frequency) x (range) to the minus 1/2 power, which has important implications. The mean frequency spacing of the interference peaks and the time dispersion of pulses are reciprocally related, and for isovelocity water both are almost independent of range and frequency. Author (GRA)

N72-19751# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE TRANSITION OF PARTIALLY STABILIZED SUPERCONDUCTIVE WINDINGS INTO THEIR NORMAL STATE
V. V. Sychev, V. B. Zenkevich, and V. A. Altov 25 Sep. 1971 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 6, 1970 p 100-104
(AD-734992; FTD-MT-24-025-71) Avail: NTIS CSCL 20/3

The results of experimental research on the transition of partially stabilized superconductive solenoids with cooled and compact windings to their normal state are introduced. The transient processes for solenoids with a cooled winding are investigated both in a vat with helium I, and in a vat with superfluid helium II. The experimental data are discussed from the point of view of existing model concepts. Author (GRA)

N72-19752# Sperry Rand Research Center, Sudbury, Mass.
MAGNETOELASTIC SURFACE WAVES Annual Report
H. Matthews and H. VandeVaart Nov. 1971 68 p refs
(Contract N00014-69-C-0027; NR Proj. 017-502)
(AD-735097; SRRC-CR-71-14) Avail: NTIS CSCL 20/12

The properties of magnetoelastic surface waves in a variety of propagating structures are presented. The characteristics of magnetostatic surface waves in a thin magnetic plate are discussed including some new features introduced when a conducting layer is on or near the surface of the plate, and when magnetocrystalline anisotropy is taken into account. Convolution and pulse compression signal processing is possible when the new features are employed. Operating principles are discussed. A demonstration of pulse compression by 325 MHz surface waves in CdS layered LiNbO3 is discussed and results are presented. Author (GRA)

N72-19753# RAND Corp., Santa Monica, Calif.
EFFECT OF PINNING ON INFINITE FILM SPIN WAVE FREQUENCIES
M. Sparks Aug. 1971 35 p refs
(AD-735081; P-4678) Avail: NTIS CSCL 20/3

The complete dispersion relations and expressions for the mode amplitudes are derived for the general ferromagnetic normal modes of an infinite film in perpendicular resonance. Several interesting limiting cases in which the general results reduced to simple forms are considered. These limiting cases include the modes near the bottom of the manifold and those for which the transverse exchange energy is negligible.
Author (GRA)

N72-19754# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
MODULATION BY LINEAR MAXIMAL SHIFT REGISTER SEQUENCES: AMPLITUDE, BIPHASE AND COMPLEMENT-PHASE MODULATION
Theodore G. Birdsall, Richard M. Heitmeyer, and Kurt Metzger Dec. 1971 36 p refs
(Contract N00014-67-A-0181-0032)
(AD-735137; Rept-036040-9-T; TR-216) Avail: NTIS CSCL 20/1

The report describes the use of linear-maximal shift-register sequences either to amplitude modulate (AM) or to angle modulate a sinusoidal carrier. Two cases of angle modulation are considered: biphase modulation (BM) and complement-phase modulation (CM). In biphase modulation the carrier angle switches between (- pi/2) and (- pi/2), whereas in complement-phase modulation the carrier angle switches between (- pi/4) and (- pi/4). It is shown that the ratio of the average power to the peak power for AM is only one-half as large as for either BM or CM. On the other hand, the ratio of the carrier power to the average power for either AM or CM is one-half, but for BM this ratio is approximately zero. Finally, a replica-correlation technique

for use with any of the three modulations is described.
Author (GRA)

N72-19755# J. G. Engineering Research Associates, Baltimore, Md.
FAR FIELD SOUND PATTERNS FROM ANISOTROPIC CYLINDRICAL SHELLS UNDER LATERAL POINT LOADING AT LOW FREQUENCIES
Joshua E. Greenspon Jul. 1971 63 p refs
(Contract N00014-71-C-0115)
(AD-735133; TR-ON-18) Avail: NTIS CSCL 20/1

The report presents an approximate theory and a computer program for calculating the far field sound radiation patterns from cross stiffened and sandwich cylindrical shells under lateral point loading. The far field radiation patterns are given for a range of low ka. It has been found that a practical structure at low frequencies acts as a dipole and then, as the frequency is increased, transforms into a quadrapole. As the frequency is increased further, the higher lobes come into the picture.
Author (GRA)

N72-19756# American Univ., Washington, D.C. Dept. of Physics.
STUDIES OF MAGNETIC PROPERTIES IN RARE EARTH ALLOYS AT CRYOGENIC TEMPERATURES Interim Report, Dec. 1969 - Mar. 1971
Romeo Segnan and Daniel Sweger 30 Mar. 1971 31 p refs
(Contract DAAK02-70-C-0102)
(AD-734925) Avail: NTIS CSCL 20/12

A Mossbauer effect source of 161Dy was prepared in a matrix of Gd203 for use in magnetic rare earth alloys studies at cryogenic temperatures. A high velocity drive (plus or minus 25 cm/sec) has been assembled for use in measuring resonant absorption in 161Dy. Data on gamma-ray spectra for the 161Dy source are presented. Author (GRA)

N72-19371# National Security Agency, Fort Meade, Md.
OPTICAL CONSTANTS OF WATER PARTICULATES FOR WAVELENGTHS IN THE VISIBLE AND INFRARED
G. D. Lukes *In* NCAR Particulate Models: Their Validity and Appl. Aug. 1971 p 129-158 refs (See N72-19357 10-13)
Avail: NTIS

N72-19951*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CRYOGEN ACQUISITION IN ORBIT
L. J. Hastings *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 107-134 refs (See N72-19945 10-33)
Avail: NTIS CSCL 20L

N72-19952*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LONG TERM CRYOGENIC STORAGE SYSTEM INTEGRATION
R. E. Stonemetz, J. H. Pratt, and T. W. Winstead *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 135-152 refs (See N72-19945 10-33)
Avail: NTIS CSCL 20L

N72-19410# Wisconsin Univ., Middleton. Geophysical and Polar Research Center.
EFFECT OF BEAM WIDTH ON ACOUSTIC SIGNALS SCATTERED AT A ROUGH SURFACE
C. S. Clay and G. A. Sandness *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 8 p refs (See N72-19394 10-13)
Avail: NTIS HC $6.00/MF $0.95

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-19757 National Lending Library for Science and Technology, Boston Spa (England).
THE EXAMINATION OF NUCLEI BY THE GRANULAR METHOD WITH REFERENCE TO ALUMINUM
C. Mascre, A. Touguet, and M. Drouzy [1961] 26 p refs Transl. into ENGLISH from Fonderie (Paris), v. 187, Sep. 1961 p 317-327 Presented at 28th Intern. Foundry Congr., Vienna, Jun. 1961
(NLL-M-20947-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

A thermal analysis technique used to determine nuclei solidification temperatures of aluminium is discussed. The method consists of using metal granules which are heated and cooled in a furnace. The solidification of each granule is shown by a peak or a level stretch line which differs from the regular cooling curve of the furnace and from the reference material. Results show nuclei solidification depends on the size of the granules used, the characteristics of the material, and the number of granules present in the specimen. Errors in measurement were found not to be greater than 1 C. E.H.W.

N72-19758*# Pittsburgh Univ., Pa. Dept. of Physics.
DISSOCIATIVE EXCITATION OF VACUUM ULTRAVIOLET EMISSION FEATURES BY ELECTRON IMPACT ON MOLECULAR GASES. 3: CO2
M. J. Mumma, W. L. Borst, and E. C. Zipf Jan. 1972 37 p refs Submitted for publication
(Grant NGL-39-011-030; Contract DA-31-124-ARO(D)-440)
(NASA-CR-125800; SRCC-162) Avail: NTIS CSCL 20H

Vacuum ultraviolet multiplets of C I, C II, and O I were produced by electron impact of CO2. Absolute emission cross sections for these multiplets were measured from threshold to 350 eV. The electrostatically focussed electron gun used in this series of experiments is described in detail. The atomic multiplets which were produced by dissociative excitation of CO2 and the cross sections at 100 eV are given. The dependence of the excitation functions on electron energy shows that these multiplets are produced by electric-dipole-allowed transitions in CO2.
Author

N72-19759*# Pittsburgh Univ., Pa. Dept. of Physics.
EXCITATION OF Na D-LINE RADIATION IN COLLISIONS OF SODIUM ATOMS WITH INTERNALLY EXCITED H2, D2, AND N2
H. F. Krause, J. Fricke, and W. L. Fite Feb. 1972 55 p refs Sponsored in part by ARPA
(Grant NGL-39-011-013)
(NASA-CR-125804; SRCC-167) Avail: NTIS CSCL 20H

Excitation of D-line radiation in collisions of Na atoms with vibrationally excited N2, H2 and D2 was studied in two modulated crossed beam experiments. In both experiments, the vibrational excitation of the molecules was provided by heating the molecular beam source to temperatures in the range of 2000 to 3000 K, which was assumed to give populations according to the Boltzmann expression. In the first experiment, a total rate coefficient was measured as a function of molecular beam temperature, with absolute calibration of the photon detector being made using the black body radiation from the heated molecular beam source. Since heating affects both the internal energy and the collisional kinetic energy, the first experiment could not determine the relative contributions of internal energy transfer versus collisional excitation. The second experiment achieved partial separation of internal versus kinetic

energy transfer effects by using a velocity-selected molecular beam. Using two simple models for the kinetic energy dependence of the transfer cross section for a given change in vibrational quantum number, the data from both experiments were used to determine parameters in the models. Author

N72-19760# Technische Hogeschool, Eindhoven (Netherlands).
A STUDY OF THE SPECTRUM OF AN ARGON ARC DISCHARGE BY HOLLOW CATHODE Ph.D. Thesis [EEN ONDERZOEK NAAR DE SPEKTRA VAN EEN ARGON BOOGONTLADING MET HOLLE KATHODE]
Bastiaan vanderSijde 14 Dec. 1971 127 p refs In ENGLISH and partly in DUTCH
Avail: NTIS

The excitation mechanism and argon I and II line intensities in a hollow cathode arc discharge are studied. A comparative analysis of the transition probabilities in the 4p group of the argon II spectrum is included. For individual titles, see N72-19761 through N72-19765.

N72-19761# Technische Hogeschool, Eindhoven (Netherlands).
GENERAL INTRODUCTION [ALGEMENE INLEIDING]
In its A Study of the Spectrum of an Argon Arc Discharge by Hollow Cathode 14 Dec. 1971 p 5-10 refs In DUTCH (See N72-19760 10-24)
Avail: NTIS

Briefly reviewed are studies on the excitation mechanism of a hollow cathode discharge and the effects of an axial aligned magnetic field on the excited argon plasma column. Absolute values for line intensities in argon I and argon II spectra and electron temperature and density profiles are calculated from microwave phase oscillations. Also determined is the population density in the 4p level of the argon II spectrum. Some electron temperature and density values are presented for currents from 10 to 100A, magnetic fields from 3 x 0.01 to 15 x 0.01T and for gas pressures of 1 x 0.001 to 1.5 x 0.001. Transl. by G.G.

N72-19762# Technische Hogeschool, Eindhoven (Netherlands).
CONFIGURATION TEMPERATURES IN A HOLLOW CATHODE ARGON ARC AND TRANSITION PROBABILITIES OF THE ARGON II SPECTRUM
In its A Study of the Spectrum of an Argon Arc Discharge by Hollow Cathode 14 Dec. 1971 p 11-52 refs Submitted for publication (See N72-19760 10-24)
Avail: NTIS

A comparison has been made between some kinds of configuration temperatures of the argon II spectrum and the temperatures of the atoms, ions and electrons for a hollow cathode, low-pressure, magnetically-confined, argon arc discharge in the 10 to 80 A current region. We found that thermalization by heavy particle collisions does not occur within the 4p group of the argon II spectrum, and that relative line intensity measurements over a large spectral range of 19 to 25 eV give hardly any relevant information on the electron temperature. It is concluded that the population densities of the excited levels are mainly determined by the excitation cross section functions for the levels concerned. Author

N72-19763# Technische Hogeschool, Eindhoven (Netherlands).
TEMPERATURE AND DENSITY PROFILES OF ELECTRONS IN A HALLOW CATHODE ARGON ARC DISCHARGE
In its A Study of the Spectrum on an Argon Arc Discharge by Hollow Cathode 14 Dec. 1971 p 53-82 refs (See N72-19760 10-24)
Avail: NTIS

Measurements have been performed of radial radiation profiles of argon I and II lines in a hollow cathode low-pressure magnetically-confined argon arc discharge with currents of 15 to 60 A. The working pressure of the discharge was about 0.001 mm of Hg and the electron density was approximately ten to the 19th power m/3. From the radiation profiles radial temperature and density profiles of the electrons have been calculated. It appears that the decrease of the electron temperature in most cases is about 10 percent per 10 mm or smaller and that the width at half-maximum value of the electron density profile for a confined plasma is about 18 mm for an end-anode configuration situated at 1.2 m from the cathode and 27 mm for a ring-shaped anode situated near the cathode. Author

N72-19764# Technische Hogeschool, Eindhoven (Netherlands).
EXCITATION MECHANISMS AND TEMPERATURES AND DENSITIES OF ELECTRONS IN A HOLLOW CATHODE ARGON ARC DISCHARGE
In its A Study of the Spectrum of an Argon Arc Discharge by Hollow Cathode 14 Dec. 1971 p 83-114 refs (See N72-19760 10-24)
Avail: NTIS

For a hollow cathode low pressure magnetically-confined argon arc discharge an investigation was made of spectral line intensities of the argon II spectrum to ascertain the excitation mechanisms in this spectrum, especially for the 4p group. It appears that for n sub e-values of 1 x 10 to the 19th power to 2 x 10 to the 19th power m/3 stepwise excitation from the ion ground levels through short lived intermediate levels contributes at least 70% to the 4p- argon II group population. Direct excitation from the ion ground levels is dominant for considerably smaller n sub e-values. Cascade radiation plays a minor role in populating the 4p group. Furthermore, the electron temperature was determined from absolute line intensity measurements of the argon I and II spectra, and the value of the electron density was calculated from phase shift measurements with microwaves. Author

N72-19765# Technische Hogeschool, Eindhoven (Netherlands).
FINAL GENERAL OBSERVATIONS [ALGEMENE SLOTBESCHOUWING]
In its A Study of the Spectrum of an Argon Arc Discharge by Hollow Cathode 14 Dec. 1972 p 115-121 refs In DUTCH (See N72-19760 10-24)
Avail: NTIS

Investigation was made of intensities of lines of the argon I and II spectra and of the radiation profiles thereof, as functions of the distance to the discharge axis for a hollow cathode low-pressure magnetically-confined argon arc discharge. It was found that thermalization by ions or neutral particles caused by collisions with heavy particles does not occur within the 4p group. For this part of the investigation, a comparative study of the transition probabilities of the 4p group was made. The excitation mechanism of the 4p group of the argon II spectrum could be ascertained; stepwise excitation from the ion ground levels through short-lived intermediate levels contributes at least 70% to the 4p group population density. Author

N72-19766*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LORENTZ-INVARIANT FORMULATION OF CHERENKOV RADIATION BY TACHYONS
Frank C. Jones Mar. 1972 34 p refs
(NASA-TM-X-65851; X-641-72-73) Avail: NTIS CSCL 20H

Previous treatments of Cherenkov radiation, electromagnetic and gravitational, by tachyons were in error because the prescription employed to cut off the divergent integral over frequency is not a Lorentz invariant procedure. The resulting equation of motion for the tachyon is therefore not covariant. The proper procedure requires an extended, deformable distribution of charge or mass and yields a particularly simple form for the tachyon's world line, one that could be deduced from simple invariance considerations. It is shown that Cherenkov radiation by tachyons implys their ultimate annihilation with an antitachyon and demonstrates a disturbing property of tachyons, namely the impossibility of specifying arbitrary Cauchy data even in a purely classical theory. Author

N72-19767*# Martin Marietta Corp., Denver, Colo. Space Physics Lab.
X-RAY SCATTERING STUDY Final Report
Robert S. Wriston and Joseph F. Froechtenigt Feb. 1972 85 p refs
(Contract NAS5-20287)
(NASA-CR-122362; MCR-72-31) Avail: NTIS CSCL 20H

A soft X-ray glancing incidence telescope mirror and a group of twelve optical flat samples were used to study the scattering of X-rays. The mirror was made of Kanigen coated beryllium and the images produced were severely limited by scattering of X-rays. The best resolution attained was about fifteen arc seconds. The telescope efficiency was found to be 0.0006. The X-ray beam reflected from the twelve optical flat samples was analyzed by means of a long vacuum system of special design for these tests. The scattering then decreased with increasing angle of incidence until a critical angle was passed. At larger angles the scattering increased again. The samples all scattered more at 44 A than at 8 A. Metal samples were found to have about the same scattering at 44 A but greater scattering at 8 A than glass samples. Author

N72-19768# Oak Ridge National Lab., Tenn.
ADDING GROUP THEORY TO KKR BAND THEORY PROGRAMS FOR FCC AND BCC STRUCTURES
J. S. Faulkner and Peter W. Milonni Nov. 1971 37 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3589) Avail: NTIS

A simple technique for adding group theory to KKR band theory calculations is described. An unsymmetrized KKR program can be converted to a symmetrized one for fcc and bcc structures by adding the two FORTRAN programs presented. Author

N72-19769# Rome Univ. (Italy). Inst. of Physics.
ON THE DETERMINATION OF THE M(1 PLUS)(3/2) AND E(1 PLUS)(3/2) MULTIPOLE AMPLITUDES OF PION PHOTOPRODUCTION ON NUCLEONS IN THE DELTA(1236) RESONANCE
A. Jurewicz (Inst. of Nucl. Res., Warsaw) 1 Jul. 1971 23 p refs Ist. Nazl. di Fis. Nucl.
(Nota-Interna-324) Avail: NTIS

The multipoles M sub 1 to the 3/2th power and E sub 1 to the 3/2th power have been determined by solving a system of integral equations resulting from the fixed angle dispersion relations. The solutions depend on one parameter: the cutoff in energy which is determined by fitting the calculated values to data. A discussion of various solutions is presented. Author (ESRO)

N72-19770# Rome Univ. (Italy). Inst. of Physics.
ANGULAR CORRELATIONS OF THE DECAY PRODUCTS OF TWO HEAVY LEPTONS
G. Parisi and F. Zirilli (CNEN, Frascati, Italy) 12 Jul. 1971 5 p refs
(Nota-Interna-327) Avail: NTIS

The angular distribution of charged particles produced during the decay of two heavy leptons is determined. ESRO

N72-19771# Nevada Univ., Reno. Dept. of Chemistry.
INELASTIC COLLISION BETWEEN MOLECULAR SYSTEMS (NEUTRAL AND/OR IONIZED) WITH RELATION TO UPPER ATMOSPHERIC PHENOMENA Final Report, 1 Sep. 1967 - 30 Nov. 1971.
Hyung Kyu Shin 8 Dec. 1971 12 p
(Grant AF-AFOSR-1354-68; AF Proj. 9539)
(AD-734291; AFOSR-71-3067TR) Avail: NTIS CSCL 07/4

The theoretical study of inelastic collisions of atoms, molecules, and molecular ions has been carried out to determine transition probabiliites among vibrational and rotational energy states. New methods have been developed and existing techniques have been refined to provide both a quantitative and a qualitative interpretation of the detailed mechanisms and dynamics of molecular collisions. Author (GRA)

N72-19772# Naval Ordnance Lab., White Oak, Md.
EVALUATION OF PLASTIC SCINTILLANTS FOR USE IN HIGH SENSITIVITY MEASUREMENTS OF LOW ENERGY GAMMA OR X-RAYS
David F. Covell and Herman I. Cordova 8 Nov. 1971 11 p refs
(ARPA Order 1798)
(AD-734398; NOLTR-71-215) Avail: NTIS CSCL 18/4

Evaluation and engineering data are presented regarding the applicability of plastic scintillants for low energy gamma and X-ray detection with special application to delayed-coincidence counting. Author (GRA)

N72-19773# San Diego State Coll., Calif. Dept. of Physics.
THE PHYSICS OF LOW ENERGY ION-MOLECULE AND CHARGE TRANSFER REACTIONS, A COMPUTER STUDY Final Report, 1 Jun. 1967 - 1 Jun. 1971
Fred A. Wolf 13 Jul. 1971 11 p refs
(Grant AF-AFOSR-1277-67; AF Proj. 9767)
(AD-734793; AFOSR-72-0005TR) Avail: NTIS CSCL 07/4

The research studied the collision processes involving charged or ionized gas molecules and neutral molecules. Studies of low-energy collisions among atmospheric gases where charge-exchange among the colliding molecules or ions are more frequent were completed. Studies were also made on the development of a computer model that will predict the velocity region for each enhanced chance of charge transfer from charged particle to neutral particle to take place. This research increased our understnding of atmospheric phenomena, communication anomalies and re-entry phenomena. Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-19774 National Lending Library for Science and Technology, Boston Spa (England).
PLASMA HEATING AND STABILITY IN A COMBINED PINCH
I. F. Kvartskhava, G. G. Zukakishvili, Yl. V. Matveev, Yu. S. Gvaladze, N. A. Razmadze, A. A. Besshaposhnikov, E. K. Tikhanov, Z. D. Chkuaseli, E. Yu. Khautiev, and I. Ya. Rutov Aug. 1971 29 p refs Transl. into ENGLISH of Inst. of Appl. Phys., Sukhlmi, USSR report CN-28/B-1 Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 1971
(NLL-CTO-773-(9091.9F); CN-28/B-1) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The results of experiments with a discharge vessel of small diameter, when there are filaments in the plasma sheath, are presented. The length of the theta magnetic coil is given as L = 21 cm and the axial magnetic field as H sub z = 65 KOe. The measurements show that for currents not exceeding the Kruskal-Shafranov value, the plasma is stable throughout the half period of the discharge current; the electron temperature, determined from the absorption of soft X-rays by aluminum foils, rises with increasing H sub z. Neutron emission is also greatest at maximum H sub z. Investigation of the axial and radial distribution of the neutron yield showed that neutrons are emitted from a plasma column with diameter < 1.5 cm and length about 15 cm. The electron density gradients along the radius of the plasma column and the electron density profiles were determined by means of the schlieren method with time resolution. Also discussed are some new MHD instabilities due to processes ocurring at the plasma/magnetic field interface and in the discharge regions near the electrodes. Author

N72-19775 National Lending Library for Science and Technology, Boston Spa (England).
BEHAVIOUR OF A HIGH-TEMPERATURE PLASMA WITH OHMIC HEATING IN THE HIGH-SHEAR STELLARATOR URAGAN
A. G. Dikii, J. G. Gorman, V. M. Zalkind, G. V. Zelenin, V. D. Kotsubanov, A. P. Litvinov, O. S. Pavlichenko, N. F. Perpelkin, O. S. Ponomarenko, and V. A. Suprunenko Aug. 1971 17 p refs Transl. into ENGLISH of Ukr. SSSR Acad. of Sci., Inst. of Appl. Phys., Kharkov, report CN-28/H-11 Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 1971
(NLL-CTO-780-(9091.9F); CN-28/H-11) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Results are given concerning the behavior of a plasma generated by ohmic discharges in the high-shear stellarator. The ohmic discharges were produced by discharging a capacitor bank through a matching transformer directly to the metal discharge vessel, which included a ceramic insulating section. Pre-ionization was by a 100 kHz oscillator with power up to 200 kW. The electron density in the plasma was measured with a phase meter. The electron temperature from the plasma conductivity, the intensity ratio of helium lines, and the radial distribution of electron density and temperature were measured by means of electrical probes. In some conditions of operation, check measurements of these radial distributions were made by means of Thomson scattering of ruby laser radiation. The results are given of measurements of the energy lifetime and charged-particle lifetime as functions of the magnetic field configuration in the stellarator. Author

N72-19776 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIMENTAL RESEARCH ON NON-LINEAR EFFECTS IN THE INTERACTION OF NON-RELATIVISTIC AND RELATIVISTIC BEAMS WITH A PLASMA
A. S. Bakai, A. K. Berezin et al Aug. 1971 36 p refs Transl. into ENGLISH of Acad. of Sci. Ukr. SSR, Inst. of Appl. Phys., Khar'kov, report CN-28/E-9 Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 1971
(NLL-CTO-776-(9091.9F); CN-28/E-9) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

An experimental investigation was carried out of the nonlinear processes of interaction of waves with particles and of waves with one another in plasma-beam discharges. The threshold excitation of low-frequency waves by high frequency waves and the induced scattering of waves on the plasma electrons were established. Experimental confirmation was obtained of the theoretically predicted effect of non linear Landau damping in a strong magnetic field (induced scattering). An investigation was made of the nonlinear stage in the development of low-frequency instabilities brought about during beam-plasma interaction. Experimental determinations were made of the spectral density of the energy of the excited electric fields, space-time correlation functions, the existence of phase jumps and the dispersion relation of excited low frequency oscillations. A study was conducted of the interaction of a relativistic electron beam with the plasma. Determinations were made of the beam energy losses caused by collective interaction of the beam with the plasma. Author

N72-19777 National Lending Library for Science and Technology, Boston Spa (England).
DENSITY DETERMINATION IN CYLINDRICALLY SYMMETRIC MEDIA FROM LIGHT BEAM DEFLECTION MEASUREMENTS
U. Kogelschatz and W. R. Schneider [1970] 6 p refs Transl. into ENGLISH from Z. Angew. Math. Phys. (Basel), v. 21, no. 4, 1970 p 667-668 In ENGLISH and GERMAN
(NLL-M-22013-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The determination of density gradients in cylindrical symmetric media from light beam deflection, using Abel integral equation, is discussed. Measurements were made on a pulsed heavy current arc of 2KA in 30 atm nitrogen. The distribution of the refractive index around the arc was calculated. Results show the calculations and measurements to be in agreement. It was also shown that the method is applicable to the quantitative evaluation of rotationally symmetric streams by schlieren photography. E.H.W.

N72-19778*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTROTHERMAL OSCILLATIONS AND THE QUASILINEAR THEORY OF ELECTRON ENTHALPY FLUCTUATIONS IN MAGNETOHYDRODYNAMIC GENERATORS AND MAGNETOPLASMADYNAMIC ARC THRUSTERS
J. Marlin Smith Washington Mar. 1972 40 p refs
(NASA-TN-D-6704; E-6660) Avail: NTIS CSCL 20I

Fluctuations in electron density and temperature coupled through OHM's Law are studied for MHD power generator and MPD arc thruster applications. The dispersion relation based on linear theory is derived, and the two limiting cases of infinite ionization rate and frozen flow are examined. The nonlinear effects of the frozen flow case are then studied in the quasilinear limit. Equations are derived for the amplitude of the fluctuation and its effect upon Ohm's Law and the electron temperature equation. Conditions under which a steady state can exist in the presence of the fluctuation are examined, and effective transport properties are determined. Author

N72-19779*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
EXPERIMENTAL PLASMA STUDIES Final Report
Michael G. Dunn Washington NASA Mar. 1972 100 p refs
(Contract NAS1-9627)
(NASA-CR-1958) Avail: NTIS CSCL 20I

The rate coefficients for the reactions C(+) + e(-) + e(-) yields C + e(-) and CO(+) + e(-) yields C + O were measured over the electron temperature range of approximately 1500 deg K to 7000 deg K. The measurements were performed in CO that had expanded from equilibrium reservoir conditions of 7060 deg K at 17.3 atm pressure and from 6260 deg K at 10.0 atm pressure. Two RAM flight probes were used to measure electron density and electron temperature in the expanding flow of a shock tunnel. Experiments were performed in the inviscid flow with both probes and in the nozzle-wall boundary layer with the constant bias-voltage probe. The distributions of electron density and electron temperature were independently measured using voltage-swept thin-wire probes. Thin-wire Langmuir probes were also used to measure the electron-density and electron-temperature distributions in the boundary layer of a sharp flat plate located on the nozzle centerline. Admittance measurements were performed with the RAM C and RAM C-C S-band antennas in the presence of an ionized boundary layer. Author

N72-19780# Laboratoire d'Aerothermique du C.N.R.S., Bellevue (France).
CALCULATION OF EQUILIBRIUM CONCENTRATIONS AND CHEMICAL TIMES IN A NITROGEN PLASMA [CALCUL DES CONCENTRATIONS A L'EQUILIBRE ET TEMPS CHIMIQUES DANS UN PLASMA D'AZOTE]
R. Prudhomme and B. Rowe Jan. 1972 41 p refs In FRENCH; ENGLISH summary
(Rept-72-1) Avail: NTIS

Composition of a mixture in a nitrogen plasma jet was calculated for different temperatures and pressures. The results were applied to the determination of the chemical times for two kinetic models. Other data were obtained for the composition and the relaxation times in the presence of irreversible phenomena, such as radiative recombination and temperature relaxation. The values of chemical times obtained show that the plasma jet is not at equilibrium. Author

N72-19781*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRACTICAL CONSIDERATIONS FOR ABEL INVERTING

OF PHOTOGRAPHIC DATA WITH APPLICATION TO THE ANALYSIS OF A 15-kW WALL-STABILIZED ARC-LIGHT SOURCE

Walter L. Snow Washington Mar. 1972 58 p refs
(NASA-TN-D-6672; L-8071) Avail: NTIS CSCL 20I

Temperature profiles were measured for agron atmospheric pressure by using absolute line and continuum intensity and were compared with stark width and shift measurements. A detailed analysis of the engineering aspects of setting up for Abel inverting deta photographically is presented. The merits of using photographic detection and of using continuum radiation for temperature profile analysis are discussed. The importance of empirically determining the optical depth is emphasized by discrepancies between measured (two-path) and calculated estimates. Author

N72-19782# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME PROBLEMS OF PLASMA ACCELERATION IN A COAXIAL SOURCE

A. G. Belikov, V. P. Goncharenko, V. M. Mishchenko, and N. M. Ivanenko 23 Aug. 1971 15 p refs Transl. into ENGLISH from Issled. Plazmennykh Sgustkov (Kiev), v. 2, 1967 p 111-117
(AF Proj. 6040)
(AD-733481; FTD-MT-24-896-71) Avail: NTIS CSCL 20/9

The article describes the time and place of the formation of rapid plasma particles. The authors conclude that in the case of short electrodes, the formation area is almost completely outside the source, whereas with long electrodes the area envelopes the interelectrode space from the gas inlet to the forward section. Some Problems of Plasma Acceleration in a Coaxial Source-Translation. Author (GRA)

N72-19783# National Bureau of Standards, Washington, D.C. Quantum Electronics Div.

THE ERRORS IN PLASMA MEASUREMENTS BY THE MICROWAVE CAVITY TECHNIQUES

K.-B. Persson and E. G. Johnson, Jr. Oct. 1971 68 p refs
(NBS Proj. 2710161; NR Proj. 012-111; ARPA Order 703)
(AD-734035; NBS-TN-607) Avail: NTIS SOD HC $0.65 as C 13.46:607 CSCL 20/9

The report presents the results of a theoretical and experimental study of the microwave cavity techniques used in measuring electron density and collison frequency in transient plasmas. Sources of errors are discussed and certain calibration procedures are recommended to minimize the error. In particular, the abnormal negative glow discharge in helium is presented as an inexpensive reference plasma for calibration purposes. Author (GRA)

N72-19784# Illinois Univ., Urbana. Coordinated Science Lab.

EXPERIMENTAL OBSERVATION OF WAVE-WAVE COUPLING IN A BEAM PLASMA SYSTEM

J. Chang, M. Raether, and S. Tanaka Sep. 1971 16 p refs
(Contract DAAB07-67-C-0199)
(AD-733909; R-528; UILU-ENG-71-2231) Avail: NTIS CSCL 20/9

The interaction between unstable waves has been investigated in a beam-plasma system under conditions such that nonlinear wave-particle interactions are negligible. At small wave amplitudes the results can be interpreted in terms of a simple three-wave decay process; at large amplitudes the situation is dominated by multiple wave coupling that leads to generation of satellite waves. Author (GRA)

N72-19785# Naval Research Lab., Washington, D.C. Plasma Dynamics Branch.

COMPUTER STUDIES OF COLLISIONLESS DAMPING OF A LARGE AMPLITUDE WHISTLER WAVE Interim Report

S. L. Ossakow, I. Haber, and R. N. Sudan Nov. 1971 15 p refs
(AD-733977; NRL-MR-2362) Avail: NTIS CSCL 20/9

The computer simulation of a single large amplitude whistler wave propagating in a plasma has been carried out. Such a wave shows an initial linear damping, then a regrowth and amplitude oscillation, and finally it settles to a constant amplitude value. These features are in good agreement with the theory. Author (GRA)

N72-19786# Naval Research Lab., Washington, D.C. Plasma Dynamics Branch.

THEORY AND SIMULATION OF THE BEAM CYCLOTRON INSTABILITY

M. Lampe, W. M. Manheimer, J. B. McBride, J. H. Orens, K. Papadopoulos, R. Shanny, and R. N. Sudan Nov. 1971 70 p refs
(AD-733976; NRL-MR-2358) Avail: NTIS CSCL 20/9

A detailed theory in conjunction with the results of computer simulation experiments is presented for the beam cyclotron instability. The main results of the study are as follows: After a period of exponential quasilinear development, turbulent wave-particle interactions become strong enough to cause cross-field diffusion of the electrons which smears out the electron gyroresonances. This level of turbulence results in a transition to ordinary ion sound modes that would occur in an unmagnetized plasma. The magnetic field serves to reduce the effects of electron trapping; This level of turbulence appears to have virtually no effect on long wavelength fluid modes; At this level the instability stabilizes if ordinary ion sound is stable due to ion Landau damping. For cold ions it continues to develop at the slower ion acoustic growth rate until the fields become strong enough to trap the ions. After the fields saturate plasma heating is observed to continue. This heating is much slower than exponential. Author (GRA)

N72-19787# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DETERMINATION OF SPATIAL AND TEMPORAL ELECTRON DEUTERIUM PLASMAS Ph.D. Thesis

Winston Kent Pendleton, III Jun. 1971 187 p refs
(AD-734246; DS/PH/71-3) Avail: NTIS CSCL 20/9

The temporal and spatial electron density distribution and the temporal variation of electron temperature have been determined in gaseous deuterium plasmas produced by a laser. In addition to these measurements, made during laser irradiation of the plasma, the plasma growth rate, laser-plasma absorption and reflection interaction, and pressure dependence of laser intensity breakdown threshold have been determined. The electron density and temperature measurements represent a major addition to the data available on laser-produced plasmas. Author (GRA)

N72-19788# Avco-Everett Research Lab., Everett, Mass.

EXPERIMENTAL STUDIES ON THE INJECTION AND CONTAINMENT OF ELECTRON CLOUDS IN A TOROIDAL APPARATUS

J. D. Daugherty, J. Eninger, and G. S. Janes Oct. 1971 55 p refs
(Contract F44620-70-C-0067; AF Proj. 9752)
(AD-734258; AFOSR-71-3101TR; RR-375) Avail: NTIS CSCL 20/9

Studies have been conducted on the production and containment of electron rich plasmas in toroidal geometries. Electron densities in excess of 3 x 10 to the 9th power/cc have been produced and contained in toroidal magnetic fields for as much as 10 milliseconds. Studies also indicate that the optimum production of large electron densities without excessive wall bombardment should be attained with a triode type injection configuration wherein the energy investment in waves and electron temperature is minimized. This configuration should be located near the major axis of the apparatus. Containment is terminated when the ion density reaches about 20 percent of the electron density. The ions are shown to be produced from atoms which are released from the walls by electron bombardment associated with inefficiencies in the electron injection process. A

technique for controlling this effect which involves electron prebombardment of the walls is described. Author (GRA)

N72-19789# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TOWARD A NONLINEAR THEORY OF AN INTERACTION OF A RELATIVISTIC BEAM WITH PLASMA
Ya. B. Fainberg and V. D. Shapiro 18 Aug. 1971 18 p refs Transl. into ENGLISH of "Vzaimodeystviye Puchkov Zaryazhennykh Chastits s Plasmov" Kiev, Acad. Nauk Ukr. SSR, 1965 p 92-103
(Contract F33657-71-D-0057)
(AD-731894; FTD-HC-23-745-71) Avail: NTIS CSCL 20/9

The dynamics of the development of instability appearing during the interaction of a relativistic uniform beam of electrons with a plasma is investigated from the initial phase through the saturating phase and the formation of a stationary spectrum of oscillations. It is assumed that the plasma is in strong magnetic field parallel to the beam direction and that the beam density is much smaller than the plasma density. The excited waves are considered to be one-dimensional and moving parallel to the beam. The kinetic equation and field equations are analyzed for several degrees of nonlinearity. It is shown that beam acceleration occurs at the expense of increasing the thermal spread of the beam and the kinetic and potential energy of the induced oscillations. For larger values of beam velocities, the instability leads to a second quasilinear phase. At lower values, the beam remains uniform. The analysis also brings out the existence of a strong oscillating additive term in such beam characteristics as density and momentum. Author (GRA)

N72-19790# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE ELECTROSTATIC CONTROL OF PLASMA MICROINSTABILITIES Ph.D. Thesis
Richard M. Potter, Jr. Jun. 1971 121 p refs
(AD-734243; DS/MATH/71-1) Avail: NTIS CSCL 20/9

Optimal control theory is applied to the problem of controlling electrostatic microinstabilities in a homogeneous electron plasma. The electrostatic microinstabilities are described by a linear integro-differential system of equations, the linearized Vlasov equations. In the class of additive distributed controls, a time varying electrostatic control produced by a control charge density is taken as a logical extension to the system equations. Author (GRA)

N72-19791# Naval Research Lab., Washington, D.C.
TURBULENT HEATING IN COMPUTER SIMULATIONS OF THE MODIFIED PLASMA TWO-STREAM INSTABILITY
Edward Ott, John B. McBride, Joseph H. Orens, and Jay P. Boris Nov. 1971 16 p refs
(AD-734128; NRL-MR-2365) Avail: NTIS CSCL 20/9

Computer simulations of the fluid-like modified two-stream instability, driven by relative electron-ion drifts across a magnetic field, show strong anomalous plasma heating. The electron and ion heating rates are comparable and result in ion thermal speeds which approach the relative speed within a few ion plasma periods. Author (GRA)

N72-19792# Naval Postgraduate School, Monterey, Calif.
ELECTROHYDRODYNAMICS (EHD) RESEARCH Final Report, 1970 - 1971
Oscar Biblarz 10 Dec. 1971 87 p refs
(AD-734977; NPS-57Z171121A) Avail: NTIS CSCL 20/9

Work with the steam injector continued during the past year. The definition of the slip parameter for unsteady flow has been used in conjunction with velocity profiles measured with a hot wire anemometer to evaluate the potential role of EHD (or EGD) in anemometry. A direct measurement of particle size (using holographic interferometry) indicated that there are no particles of size 0.0001 or greater. A computer program describing the EHD flow has been written. Author (GRA)

N72-19793# California Univ., Los Angeles. Dept. of Physics.
TRAPPED PARTICLE PHENOMENA AND NONLINEAR INTERACTION BETWEEN ELECTROMAGNETIC WAVES AND PLASMAS Final Report
Alfred Y. Wong Dec. 1971 5 p refs
(Grant AF-AFOSR-0962-67)
(AD-734782; AFOSR-72-0037TR) Avail: NTIS CSCL 20/9

Trapped particle phenomena are clarified by a time resolution technique. The author found that oscillatory structures cannot always be attributed to trapped particles; interaction between bursts and waves could give rise to similar interference pattern. Techniques demonstrate the propagation of electron waves directly and do not require any lock-in detection techniques which tend to mask the contribution of electron bursts. In addition, new nonlinear states of electron waves are found. Greater understanding of plasma heating by electromagnetic waves is gained during the grant period. The author found that plasma heating at the cut-off location is possible and desirable, since no accessibility problem arises. The laboratory demonstration of this effect makes direct connections to the ionospheric modification experiments. The laboratory experiment is very helpful to fusion researchers since they can now use lasers to heat plasmas at cut-offs instead of resonance. Author (GRA)

N72-19794# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
CHARACTERISTICS OF AN ARGON FREE JET EXPANDED FROM A HIGH PRESSURE INDUCTIVE ARC SOURCE
W. F. Payne Jul. 1971 191 p refs
(Contract Nonr-4073(00))
(AD-734685; UTIAS-165) Avail: NTIS CSCL 20/9

A study has been made of the free jet flow field of argon heated by an inductive arc and expanded into a low density wind tunnel. The objective was to obtain high expansion velocities, and thus arc operating pressures from 0.4 to 1.0 atmosphere were chosen to ensure near-thermodynamic equilibrium of the gas before expansion. Author (GRA)

N72-19795# RAND Corp., Santa Monica, Calif.
BREMSSTRAHLUNG POWER DENSITY: SEMI-CLASSICAL CALCULATIONS
G. E. Modesitt Jul. 1971 8 p refs
(AD-735080; P-4677) Avail: NTIS CSCL 20/9

Quantum limitations on classical bremmstrahlung calculations are discussed. It is shown that the minimum impact parameter for low energy (< or about = 13 eV) electrons is about = ((e sup4)(h/2 pi)/(m sup 3)(v sup 5)) sup 1/3. Oppenheim's results, purporting to show that the power radiated in a plasma is greater than previously predicted, are explained and shown to be invalid. Author (GRA)

N72-19796# New York Univ., N.Y.
IMPULSE RESPONSE OF A KINETICALLY DESCRIBED NON-UNIFORM PLASMA BOUNDED IN SHEATHS
Rudolf A. Frisch and B. R. Cheo Oct. 1971 115 p refs
(Contract N00014-67-A-0467-0018; NR Proj. 371-147)
(AD-735130; TR-402-9) Avail: NTIS CSCL 20/9

The impulse response of a kinetically defined, non-uniform electron plasma slab bounded by sheaths is obtained. The one-dimensional Vlasov-Poisson system is considered. Electron-free boundaries are specified for all time. Possible equilibrium states are studied; under relatively loose mathematical conditions the electron distribution is separable and the only possible velocity distribution is Gaussian. Admissible initial conditions are investigated. The equilibrium plasma is stimulated by an impulse electric field which imparts upon all electrons an equal additional velocity. A numerical scheme is developed which permits to obtain reliable solutions for certain time periods after which numerical instabilities begin to appear. Throughout this study, considering plasma slabs with an equilibrium temperature around 30000K and a plasma frequency of approximately 1 GHz at the center of the slab, reliable solutions were obtained for the spans ranging from 2 plasma periods for strong stimuli to 20 plasma periods in linear operation. Author (GRA)

N72-19797# Avco Corp., Williamsport, Pa.
DESIGN AND FABRICATION OF A HIGH-OBSERVABLES MASS INJECTION SYSTEM FOR A HYPERSONIC ROCKET SLED NOSE CONE Technical Report, Jul. 1969 - Sep. 1970
F. L. Tempesta and G. K. Castle Oct. 1971 182 p refs
(Contract F29601-69-C-0137)
(AD-734748; AVSD-0082-71RR; AFWL-TR-70-142) Avail: NTIS CSCL 20/9

A high-speed rocket sled experiment was designed by the Air Force Weapons Laboratory to produce a partially ionized gas layer around the rocket sled's nose cone similar to that which would occur during atmospheric reentry of an actual flight vehicle. To generate the comparable electron density levels at the relatively lower rocket sled speeds, a passive mass injection system was developed to enhance natural electron concentrations by injecting highly combustible and easily ionizable species into the turbulent boundary layer. Author (GRA)

N72-19798# Air Force Academy, Colo. Frank J. Seiler Research Lab.
COMPUTER SOLUTION OF THE MAGNETIC SHOCK-TUBE PROBLEM Interim Scientific Report
Roger W. Gallington Dec. 1971 10 p refs Presented at the Tokyo 1971 AECA Symp. on Simulation of Complex Systems, Tokyo, 3-7 Sep. 1971
(AF Proj. 7905-00-12)
(AD-735010; SRL-TR-71-0021) Avail: NTIS CSCL 20/9

A three fluid (electrons, ions and neutrals) model of an electrical current sheet is investigated numerically on the computer resulting in particular solutions to the magnetic annular shock tube problem appropriate to given laboratory boundary conditions. A two-point boundary value problem involving a highly non-linear ordinary differential equation and an initially unknown interval of integration is solved. The equation and the far boundary condition are such that different methods for correcting the assumed initial conditions are required depending on the sign of the error. Adequate techniques for estimating the interval of integration and correcting the initial condition to arrive at the desired far boundary conditions are demonstrated. Magnetic shock tube performance and ranges of validity of the three fluid current sheet model are predicted by systematic variation of the laboratory boundary conditions and repeated computation. Results of this research have potential use in new methods for accelerating gases, applicable in low-thrust, long-duration aerospacecraft propulsion devices for extended-mission space vehicles. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-19799 National Lending Library for Science and Technology, Boston Spa (England).
OPTICAL AND ELECTRICAL PROPERTIES OF COPPER SULPHIDE FILMS
N. A. Vlasenko and Ya. F. Kononets Jan. 1972 9 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 2, 1971
(NLL-RTS-6830) Avail: Natl. Lending Library, Boston Spa, Engl.: £ 0.80 or 3 NLL photocopy coupons

An attempt was made to examine the electrical and optical properties of copper sulfides of various compositions and the property dependence on sulfur content in the lattice, as a function of saturation. The high resistance semiconductor material Cu2S was investigated, as well as its transformation to CuS, which has metallic properties. K.P.D.

N72-19800 National Lending Library for Science and Technology, Boston Spa (England).
METHODS OF MEASURING THE DIELECTRIC STRENGTH OF THIN LAYERS OF MOULDED DIELECTRICS SET IN THE FREE STATE
W. Gregorczyk Jan. 1972 19 p refs Transl. into ENGLISH from Elektron. (Warsaw), no. 5, 1970 p 87-91
(NLL-RTS-6727) Avail: Natl. Lending Library, Boston Spa, Engl.: £ 1.80; 6 NLL photocopy coupons

The causes of weak places, or areas of reduced dielectric strength, in thin layers of dielectrics are discussed. Methods are considered for measuring the maximum voltage which can be sustained by thin dielectric layers. The methods are based on knowledge of (1) current flow or insulation resistance as functions of applied voltage, (2) number of dielectric penetrations in relation to applied voltage, and (3) variation in the ratio of capacitances, C/C sub o, in terms of regenerating voltage. The methods described lend themselves to measurement of maximum voltage which can be sustained by capacitors having dielectric layers not less than 2000 A in thickness (0.2 microns). K.P.D.

N72-19801 National Lending Library for Science and Technology, Boston Spa (England).
SWITCHED POWER LIMIT OF P-N-P-N STRUCTURES, TURNED OFF BY A GATE CURRENT PULSE
P. E. Ayazyan, I. V. Grekhov, and I. A. Liniichuk [1971] 5 p refs Transl. into ENGLISH from Fiz. Tekh. Poluprov. (Leningrad), v. 5, no. 1, 1971 p 141-143
(NLL-M-22048-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of experimental research on thermal processes in p-n-p-n structures switched off by a gate current pulse are presented. It is shown that at a certain value of the anode current, immediately after the influence of the gate pulse has ceased, the structure changes over to a switched on condition. Further increase in the anode current results in the structure not switching off, even during the time that the control signal acts. This leads to a marked thermal signal increase. The thermal part of the structure which is switched off last imposes a limit on the power range switched off by p-n-p-n structures. F.O.S.

N72-19802*# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
A THIN POLYMER INSULATOR FOR JOSEPHSON TUNNELING APPLICATIONS Semiannual Report, Sep. 1971 - Feb. 1972
C. W. Wilmsen and J. C. Robertson Feb. 1972 30 p refs
(Grant NGR-06-002-094)
(NASA-CR-125685) Avail: NTIS CSCL 20L

The progress made towards forming thin organic layers on superconductors and how these layers effect the transition temperature is discussed. The work was primarily directed towards 1) synthesis of the organics, 2) deposition of organics, and 3) setting up to make transition temperature measurements. The greatest effort was placed on synthesis, and most of the synthesis procedures are now perfected. Author

N72-19803# Technische Hochschule Munchen (West Germany).
BOUNDARY LAYER STUDIES ON InSb-Si-HETERO TRANSFERS Ph.D. Thesis [GRENZSCHICHTUNTERSUCHUNGEN AN INSB-SI-HETEROUEBERGAENGEN]
Klaus Berchtold 16 Jun. 1971 76 p refs In GERMAN
Avail: NTIS

Interfacial transport properties of vapor deposited indium antimony layer heterojunctions on silicon substrates are analyzed. Capacitance measurements on the polycrystal boundary layer at variable temperatures show that tunneling processes block InSb-Si heterojunction transport. A theoretical model is formulated for the internal field emission of silicon valency electrons into the InSb conduction band that describes the current-voltage characteristics; the important tunnel barrier in this model is determined through the width of the forbidden InSb band and the valency discontinuity. Transl. by G.G.

N72-19804*# Scientific Translation Service, Santa Barbara, Calif.
THE CONDUCTIVITY OF SOLID ELECTROLYTES. PART 3: THE CONDUCTIVITY OF Ag3SI
T. Takahaski and O. Yamamoto Washington NASA Mar. 1972 16 p refs Transl. into ENGLISH from Denki Kagaku (Tokyo), v. 32, 1964 p 610-615
(Contract NASw-2035)
(NASA-TT-F-14200) Avail: NTIS CSCL 20L

Ag3SI was synthesized by heating an equimolar mixture of silver iodide and silver sulfide for 17 hours at 550 C. The sulfur vapor pressure was changed during synthesis of Ag3SI. As a result, when the sulfur vapor pressure was low, the electron conductivity had a larger value than when the sulfur vapor pressure was high. Ag3SI synthesized with a sulfur vapor pressure of 1 atm or higher has an extremely small electron conductivity. The ionic conductivity of Ag3SI is about 1,000 times greater at room temperature than that of other solid electrolytes which have been publicized thus far. The lattice constant of Ag3SI synthesized at a sulfur vapor pressure of 1 atm was 4.910 A at 25 C. Ag3SI does not start decomposition until 800 C. Author

N72-19805*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-TEMPERATURE SOLID-STATE PHASE TRANSFORMATIONS IN 2H SILICON CARBIDE
Herbert A. Will and J. Anthony Powell Washington Mar. 1972 33 p refs
(NASA-TN-D-6717; E-6545) Avail: NTIS CSCL 20L

Single crystals of 2H SiC were observed to undergo phase transformations at temperatures as low as 400 C. Some 2H crystals transformed to a structure with one-dimensional disorder along the crystal c axis. Others transformed to a faulted cubic/6H structure. The transformation is time and temperature dependent and is greatly enhanced by dislocations. Observations indicate that the transformation takes place by means of a slip process perpendicular to the c axis. Cubic SiC crystals were observed to undergo a solid state transformation above 1400 C. Author

N72-19806# Case Western Reserve Univ., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM. THE LOW TEMPERATURE GRUNEISEN PARAMETER OF SOME SEMICONDUCTORS FROM ELASTICITY DATA
Dennis Allen Swyt Jan. 1971 140 p refs
(Contract AT(11-1)-623)
(COO-623-167; TR-71) Avail: NTIS

The low temperature Gruneisen parameter has been determined from elasticity data for the elemental semiconductors, Si and Ge, and the semiconducting III-V compounds, GaAs, InAs and InSb. Elastic constants were measured from 300 to 4.2 K and pressure derivatives from 300 to 77 K by a conventional pulse echo technique and show good agreement with the results of other workers. The parameter values calculated from the present elasticity data are systematically lower than those obtained from low temperature thermal expansion measurements. The difference between elastic and thermal parameters cannot be accounted for experimental uncertainties and apparently has no basis in present theory. Author

N72-19807# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
SOLID STATE PHYSICS PROGRAM. ACCURATE DETERMINATION OF DIELECTRIC PROPERTIES Ph.D. Thesis
Carl Gustav Andeen Jun. 1971 55 p refs
(Contract AT(11-1)-623)
(COO-623-169; TR-73) Avail: NTIS

A systematic effort has been made to obtain accurate values for several dielectric properties of insulating crystals. The dielectric properties of interest are the static dielectric constant (SDC), the pressure dependence of the SDC, the temperature dependence of the SDC, and the frequency dependence of the SDC. This work has resulted in a technique, the method of substitution, which obsoletes all previous methods for determining the SDC. The pressure dependence of the SDC has been used as the basis of a highly accurate pressure gauge. Preliminary results for the temperature dependence of the SDC have led to an extension of this work into the investigation of impurity effects on dielectric properties. Author

N72-19808# Case Western Reserve Univ., Cleveland, Ohio.
SOLID STATE PHYSICS PROGRAM Annual Progress Report
Nov. 1971 34 p refs
(Contract AT(11-1)-623)
(COO-623-173) Avail: NTIS

Thin film physics, cohesive properties of crystals, and solid state theory are discussed. A technique for rapid determination of the small grain size in films is evaluated. An origin of mechanical stress in nickel films was calculated, using only the grain size as the single adjustable parameter. Capacitance was measured as a pressure gage. Author

N72-19809# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
SOLID STATE PHYSICS PROGRAM. UHV MOESSBAUER EMISSION SPECTRA IN THIN IRON FILMS Ph.D. Thesis
Matesh Narayan Varma 9 Jun. 1971 99 p refs
(Contract AT(11-1)-623)
(COO-623-170; TR-74) Avail: NTIS

Mossbauer spectra of thin iron films in the thickness range 1 A to 42 A at temperature from 15 K to 350 K have been studied. The films were condensed and analyzed in ultrahigh vacuum. It was observed that the films were magnetically stable when the particle size is about 90 A at room temperature and showed a transitional behavior for particle size of the order of 85 A at room temperature corresponding to the superparamagnetic fluctuation frequency of 1.2 x 10 to the 8th power radian/sec. The films having particle size of about 70 A showed a doublet spectrum at room temperature; this spectrum was interpreted in terms of superparamagnetic fluctuations and is explained as arising from magnetic hyperfine interaction and not from electric quadrupole interaction. The large separation of the doublet in the 0.4 A film is explained in terms of an electric field gradient experienced by the iron nuclei due to the glass substrate or some contamination present on the surface of the substrate. A value of 6.7 x 10 to the 17th power volts/sq cm is estimated for the electric field gradient. Author

N72-19810# Rome Univ. (Italy). Inst. of Physics.
TEMPERATURE DEPENDENCE OF THE POLARITON DISPERSION AND DAMPING IN GALLIUM PHOSPHIDE. AN APPLICATION OF THE NONLINEAR SPECTROSCOPY IN THE k VECTOR SPACE
F. DeMartini and J. Leroy (Mons Univ. Belgium) 1 Jul. 1971 12 p Sponsored jointly by CNR and Direc. de Rech. et Moyens d'Essai
(Nota-Interna-325) Avail: NTIS

Two-photon nonlinear spectroscopy in the momentum space of elementary excitations in solids exhibiting a large group-velocity was applied to the study of the dispersion of phonon polaritons in gallium phosphide. An experiment is described in which the study of the temperature effect of the optical response of gallium phosphide crystals in the polariton region leads to quantitative information on the damping processes. The experimental design is described. ESRO

N72-19811# Army Foreign Science and Technology Center, Charlottesville, Va.
CERTAIN PROBLEMS OF ELASTICITY THEORY FOR DOUBLY CONNECTED REGIONS
M. A. Savruk 22 Sep. 1971 14 p ref Transl. into ENGLISH from Visn. Politekh. Inst. (Lvov), no. 16, 1967 p 37-45

(AD-733617; FSTC-HT-23-493-71) Avail: NTIS CSCL 20/11

Contents: Strains in an Obliquely Truncated Rod with a Circular Eccentrically Arranged Opening Under the Effect of Shear; On the Transverse Extension of an Obliquely Truncated Rod With Rings and an Eccentrically Arranged Excision Near the Cut Edge. GRA

N72-19812# Aerospace Corp., El Segundo, Calif.
CURRENT NOISE IN JOSEPHSON POINT CONTACTS Technical Report, Jul. - Dec. 1969
Helmut Kanter and Frank L. Vernon, Jr. 1 Nov. 1971 15 p refs
(Contract F04701-71-C-0172)
(AD-733710; TR-0172(9230-10)-4; SAMSO-TR-71-275) Avail: NTIS CSCL 20/12

The dependence and magnitude of noise currents in superconducting point contacts on dc current and voltage has been measured. The results are in good agreement with the theoretical predictions of Scalapino and Stephen. As expected, in the shot-noise limit at sufficiently high junction voltage the noise current does not vary with temperature. Author (GRA)

N72-19813# Yeshiva Univ., New York. Belfer Graduate School of Science.
ELECTRONICS AND PHYSICS OF INTERACTING SYSTEMS Final Scientific Report, 1968 - 1971
Daniel Mattis 23 Nov. 1971 8 p refs
(Grant AF-AFOSR-1642-69; AF Proj. 9763)
(AD-733882; AFOSR-71-3049TR) Avail: NTIS CSCL 20/12

A report is made on research in areas of phase transitions, magnetic impurities in metals, and electronic properties of Random Materials. GRA

N72-19814# GTE Labs., Inc., Bayside, N.Y.
JUNCTION GROWTH TECHNIQUES FOR GaAs AVALANCHE TRANSIT TIME DEVICES Final Report, 1 Jul. 1970 - 30 Jun. 1971
James F. Black and Richard H. Deitch Ft. Monmouth, N. J. ECOM Dec. 1971 96 p refs
(Contract DAAB07-70-C-0320; DA Proj. 1H6-62705-A-056)
(AD-734334; TR-71-837.7; ECOM-0320-F) Avail: NTIS CSCL 20/12

A summary is presented of the results that were achieved in preparing GaAs wafers in p-/n/n configuration for use in fabricating avalanche transit-time devices. The n/n- and p-/n junctions were formed by growing epitaxial layers using a new technique of growth from the liquid phase known as Transient-Mode Liquid Epitaxy (TMLE). The n- substrates were low-dislocation-density Si-doped GaAs wafers prepared by bulk crystal growth gradient-freeze techniques. A description is given of the apparatus and growth procedures used. Methods for characterizing the material throughout the various processing steps are discussed with emphasis placed on nondestructive techniques. The relationship of wafer properties to some microwave device operation results is included. Author (GRA)

N72-19815# Aerospace Corp., El Segundo, Calif. Lab. Operations.
NOISE VOLTAGE IN JOSEPHSON JUNCTIONS Research Report, Jan. - Jun. 1969
H. Kanter and F. L. Vernon, Jr. 1 Nov. 1971 12 p refs
(Contract F04701-71-C-0172)
(AD-734257; TR-0172(9230-10)-3; SAMSO-TR-71-293) Avail: NTIS CSCL 20/12

The theoretical prediction of voltage across Josephson junctions due to thermal noise currents is shown to be in reasonable agreement with experiments in which noise currents of variable 'temperature' were produced by the radiation of a gas discharge. Author (GRA)

N72-19816# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
TESTING FOR AN ORGANIC SUPERCONDUCTOR
Forrest J. Agee, Jr. Sep. 1971 41 p refs
(DA Proj. 1T6-62705-A-012)
(AD-734319; USAMERDC-2013) Avail: NTIS CSCL 20/12

The report describes a magnetic susceptibility apparatus and test procedure devised to detect superconductivity in organic materials and the results of tests made on samples synthesized in a number of laboratories. A review of the organic and high-temperature superconductivity problem is presented with suggestions for further research. Author (GRA)

N72-19817# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
ELECTRO-OPTIC CRYSTAL HOMOGENEITY STUDY Final Technical Report
Edward N. Farabaugh, Avery T. Horton, Floyd A. Mauer, and Curt W. Reimann Griffiss AFB, N. Y. RADC Nov. 1971 23 p refs
(Contract F30602-70-F-0074)
(AD-734250; NBS-10428; RADC-TR-71-229) Avail: NTIS CSCL 20/2

The study consisted of the growth of single crystals of electro-optic potassium dideuterium phosphate KD2PO4 of size and optical quality suitable for use in display device applications and an X-ray topographic study of sliced KD2PO4 crystals. The X-ray study was carried out to investigate the relationship between dislocations in the crystals and non-uniform image decay in the devices. Three crystals were grown and six devices were constructed using crystal wafers of about 1-1.5 sq in. cross section. Author (GRA)

N72-19818# John Carroll Univ., Cleveland, Ohio. Dept. of Physics.
LOW TEMPERATURE ULTRASONIC ATTENUATION AND VELOCITY STUDIES IN METALS Final Report
Joseph Trivisonno, Jr. 30 Nov. 1971 12 p refs
(Grant AF-AFOSR-1479-68; AF Proj. 9763-02)
(AD-734271; AFOSR-71-3019TR) Avail: NTIS CSCL 20/12

The attentuation of a high frequency sound wave in a pure metal at low temperatures is dominated by the interaction of the wave with the conduction electrons. This research is concerned with an experimental and theoretical study of this interaction in metals and superconductors. The metals studied included cesium, magnesium, and niobium. A large part of the effort also includes the growth of high purity crystals and design of an ultrasonic system which automatically measures the attenuation in the presence of noise. Author (GRA)

N72-19819# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
ENERGETICS AND TOPOGRAPHY OF INTERFACE PHENOMENA Final Report
William A. Tiller 25 Nov. 1971 13 p refs
(Grant AF-AFOSR-1360-68; AF Proj. 9761)
(AD-734284; SU-DMS-72-R-25; AFOSR-71-3016TR) Avail: NTIS CSCL 07/4

An entirely new foundation for the investigation of interfaces has been laid and partially consolidated via 42 scientific publications plus the support and development of 14 Ph.D. students. By detailed investigation of the five component parts of the excess free energy of an interface, it has been possible to clearly model many complex multi-parameter, multi-variable processes taking place at interfaces. Significant accomplishments relate to new approaches to stress corrosion cracking, surface creation during phase transformations and to a realistic model for crystal-liquid interfaces. Author (GRA)

N72-19820# Pennsylvania Univ., Philadelphia. Dept. of Physics.
ELECTRODYNAMICS AND FLUCTUATION PHENOMENA IN JOSEPHSON JUNCTIONS Final Report, 1 Mar. 1968 -

31 Aug. 1971
D. N. Langenberg 23 Dec. 1971 13 p refs
(Contract DAHC04-68-C-0021; DA Proj. 200-61102-B-11-B)
(AD-734361; AROD-7590-12-P) Avail: NTIS CSCL 20/12

Topics include plasma excitation in Josephson tunnel junctions, coupling of Josephson junctions to external circuits, small tunnel junctions, parametric oscillations in Josephson junctions, current power spectrum in tunnel junctions, two-particle collective states, and time-dependent superconductivity.
Author (GRA)

N72-19821# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
[SOLID STATE PHYSICS, CONTROL THEORY, AND ELECTROMAGNETIC PHENOMENA OF ANTENNAS] Semiannual Progress Report, covering period 1 Jan. - 30 Jun. 1971
Oct. 1971 73 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0008; N00014-67-A-0298-0005)
(AD-733971; SAPR-82) Avail: NTIS CSCL 20/12

Contents: Very low frequency wave propagation; Electron and solid state physics; Control theory and applications; Electronic networks and instrumentaiton; Physics of ferromagnetic and ferroelectric materials; Electromagnetic phenomena. GRA

N72-19822# University of Southern Calif., Los Angeles. Dept. of Materials Science.
ELECTRICAL PROPERTIES AND DEFECT CHEMISTRY OF ALUMINUM OXIDE Final Progress Report, 1 Dec. 1968 - 30 Nov. 1971
F. A. Kroger Nov. 1971 5 p refs
(Contract N00014-69-A-0269-0007)
(AD-734149) Avail: NTIS CSCL 20/12

A summary of work done from December 1, 1968 - November 30, 1971 is given. It was attempted to determine the defect structure of Alpha Al2O3 at high temperatures by carrying out measurements of emf of concentration cells, high-temperature conductivity of pure and doped Al2O3, weight-change measurements, valency changes of cobalt in cobalt-doped Al2O3. Author (GRA)

N72-19823# American Univ., Cairo (Egypt). Dept. of Materials Engineering and Physical Sciences.
ELECTRICAL CONDUCTIVITY IN GLASSES AND GLASS-METAL COMPOSITES Final Report, 1 Feb. 1967 - 31 Jan. 1971
Adli Bishay 24 Nov. 1971 110 p refs
(Contract F61052-67-C-0050; AF Proj. 9763)
(AD-734252; AFOSR-71-3099TR) Avail: NTIS CSCL 20/12

Electrical properties of some semiconducting glasses (calcium phosphate, calcium borate, lead borate) containing iron and other transition metal oxides were studied. Interesting switching properties were discussed. Also some physical and mechanical properties of glass-aluminium composites were studied.
Author (GRA)

N72-19824# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
RADIATION DAMAGE EFFECTS IN ELECTRON IRRADIATED CADMIUM SULFIDE PLATELETS AT LOW TEMPERATURE Ph.D. Thesis
C. Neale Elsby Aug. 1971 143 p refs
(AD-734239; DS/PH/71-5) Avail: NTIS CSCL 20/12

A study was made of the luminescence properties of cadmium sulfide platelets which were bombarded at near liquid helium temperature with fast electrons at energies above 100 keV. Photoluminescence and cathodoluminescence spectra were evaluated. Post-irradiation annealing and thermal and optical quenching experiments were conducted. Author (GRA)

N72-19825# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
A RADIATION EFFECTS RESEARCH PROGRAM Annual Report, 1 Sep. 1970 - 31 Aug. 1971
W. W. Grannemann, R. C. Allen, Jr., L. T. Boatwroght, W. J. Byatt, and H. D. Southward Sep. 1971 174 p refs
(Contract N00014-68-A-0158)
(AD-734160; EE-192(71); ONR-005) Avail: NTIS CSCL 20/12

Contents: Radiation effects on gallium arsenide phosphide and gallium phosphide Schottky barrier diodes; Diffusion of Zn in GaAsP; Low volume depletion region Schottky barrier diodes; Neutron and gamma radiation effects in GaAs laser diodes and bulk materials; MIS (Metal-Insulator-Semiconductor) studies; Fabrication and testing of GaAsP MIS capacitors; Thermal oxidation of gallium arsenide phosphide; Electron beam irradiation studies; Magnetoresistance and radiation effects on electron beam evaporated high mobility thin films of indium antimonide; Hall effect in dielectric material; Micro-hall device studies; Radiation effects on epitaxial silicon; Semiconductor modeling study; Electrons in disordered crystals; Application of invariant imbedding methods to problems of transport theory and wave propagation. GRA

N72-19826# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTRON EMISSION STUDIES OF THE IIB-VIA SEMICONDUCTOR COMPOUNDS Ph.D. Thesis
Charles Joseph Vesely Jun. 1971 100 p refs
(AD-734241; DS/PH/71-2) Avail: NTIS CSCL 20/12

X-ray induced electron emission measurements were used to determine the energy levels of core electrons in ZnO, ZnS, ZnSe, ZnTe, CdO, CdS, CdSe, CdTe, HgS, HgSe and HgTe. The investigated energy range extends from the bottom of the valence band (6-8 eV below the Fermi level) to about 1200 eV below the Fermi level. Chemical shifts were determined by comparing the results of these measurements with experimental values for the pure elements. These shifts are plotted as a function of the fractional ionicity values determined by Phillips and Van Vechten, Pauling and Coulson. Core level values for ZnSe and CdTe are compared with self-consistent relativistic orthogonalized plane wave calculations for the excitation energies of these compounds. Author (GRA)

N72-19827# Utah Univ., Salt Lake City. Dept. of Physics.
ELECTRONIC AND RADIATION DAMAGE PROPERTIES OF RUTILE Technical Report, period ending 30 Nov. 1971
John W. Deford, Owen W. Johnson, and Franz Rosenberger 30 Nov. 1971 34 p refs
(Contract DAHC15-71-G-0008; ARPA Order 1610)
(AD-734210) Avail: NTIS CSCL 20/12

The report discusses the work done during the first 17 months on the electronic and radiation damage properties of rutile. Work was divided into the following areas: Crystal growth, dielectric loss, devices, hall effect, radiation damage, theory and data analysis, optical absorption spectroscopy, photoconductivity and photoemission, review paper, and ultrasonic attenuation. In each area a brief review of the proposal expectation is given, followed by a description of what has been accomplished. Author (GRA)

N72-19828# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
INTERNAL FRICTION IN GERMANIUM AT LOW TEMPERATURES
William L. Haworth, Richard F. Mattas, and Howard K. Birnbaum Nov. 1971 22 p refs
(Contract N00014-67-A-0305-0020)
(AD-734108) Avail: NTIS CSCL 20/12

The internal friction of germanium crystals having various dislocation densities in the range of 1000/sq. cm. to about 10 to the 7th power/sq. cm. was measured in the low KHz frequency range from 80 K to 473 K and in the MHz frequency

range at 300 K. No evidence for a dislocation contribution to the internal friction was obtained. The internal friction was amplitude independent and could be accounted for by thermoelastic damping. The results were independent of the doping levels of the germanium crystals and of their orientations. Author (GRA)

N72-19829# Pennsylvania State Univ., University Park. Materials Research Lab.
CONTACTS BETWEEN CHALCOGENIDE GLASSES, METALS AND SEMICONDUCTORS Semiannual Technical Report
H. K. Henisch 1 Dec. 1971 39 p refs
(Contract DAHC04-70-C-0047; ARPA Order 1562)
(AD-734117) Avail: NTIS CSCL 20/12

Contents: Problems under experimental investigation; Nature of the OFF-characteristic; OFF-stage and switching behavior for different modes of address; Scaling problems; Recovery processes; Amorphous semiconductor switching; Behavior of amorphous semiconductor films between asymmetric electrodes. GRA

N72-19830# Naval Ordnance Lab., White Oak, Md.
PREPARATION AND PROPERTIES OF EPITAXIAL LEAD SULFIDE INFRARED DETECTORS
Richard B. Schoolar 15 Oct. 1971 60 p refs
(AD-734384; NOLTR-71-223) Avail: NTIS CSCL 20/12

A new method is reported for growing high quality, epitaxial Pb S films under near equilibrium conditions. Both n and p-type films ranging in carrier density from 1x10 to the 17th power to 3x10 to the 18th power/cc were prepared by adjusting their stoichiometry during the growth phase. A study of the photoconductive properties of these films indicates that excess carrier lifetimes are less than the radiative lifetimes due to recombination at shallow Shockley-Read centers. Photoconductive and photovoltaic infrared detectors were prepared from the films. The photovoltaic detectors were Schottky barriers formed by evaporating indium onto p-type Pb S films. The author concludes that the Pb S Schottky barrier photodiodes are superior in performance to the epitaxial photoconductive detectors. Author (GRA)

N72-19831# Army Materials and Mechanics Research Center, Watertown, Mass.
GRAIN BOUNDARY CONTRAST IN FIELD ION MICROSCOPE IMAGES
Robert D. French and George H. Bishop, Jr. Aug. 1971 22 p refs
(DA Proj. 1T0-61102-B-32-A)
(AD-734839; AMMRC-TR-71-30) Avail: NTIS CSCL 20/2

The contrast in field ion microscopy images due to (110) symmetric tilt boundaries in a bcc lattice was systematically investigated for misorientations up to 26 degrees by computer image simulation. In low-angel grain boundaries, there are three contrast effects: dislocation spirals, cusps in plane edges, and zone-line displacement. The way in which those contrast effects develop with increasing tilt angle is discussed and illustrated with image simulations. An important result is that under favorable conditions, contrast due to the boundary dislocations could still be resolved in the simulation of the high-angle 26 degree boundary. Author (GRA)

N72-19832# Defence Research Information Centre, Orpington (England).
MECHANISM OF THE TRANSFER OF CURRENT IN THE CONTACT METAL-GALLIUM ARSENIDE
A. B. Vyatkin and N. K. Maksemova Dec. 1971 13 p refs Transl. into ENGLISH from J. Soviet Phys. (USSR), no. 1, 1971 p 82-87
(AD-734512; DRIC-Trans-2520; BR-27463) Avail: NTIS CSCL 20/12

The mechanism of the transfer of current in diodes with the Shottky barrier, obtained by electrochemical deposition of metal on the surface of gallium arsenide, was investigated. The volt-ampere characteristics of junctions of nickel n-type gallium arsenide were examined in the temperature range 180-370K. GRA

N72-19833# Illinois Univ., Urbana. Dept. of Computer Science.
COLORMATRIX: A THERMALLY CONTROLLED LIQUID CRYSTAL ALPHANUMERIC DISPLAY M.S. Thesis
Stavros Alexandros Hadjistavros Jun. 1971 65 p refs
(Contract N00014-67-A-0305-0007)
(AD-734442; UIUCDC-R-71-486) Avail: NTIS CSCL 09/5

The basic idea employed by COLORMATRIX involves using the thermal properties of cholesteric liquid crystals have the property of selectively reflecting different wavelengths of incident white light as their temperature is changed. This phenomenon is reversible and the spectrum of the reflected light is a function of both the chemical composition and the temperature. Since liquid crystals are light reflecting devices, low power consumption and high contrast are their main advantages; however, their reflectance is low. Author (GRA)

N72-19834# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.
THE IN SITU FORMATION OF GERMANIUM THIN FILMS
Herbert Kivlighn Dec. 1971 24 p refs
(AD-734745; RM-526) Avail: NTIS CSCL 20/12

A novel method was discovered for forming thin films of germanium on oxygen-deficient glasses prepared from germanium dioxide. It appears that the potential exists for developing films with amorphous or crystalline character. The best results are obtained when the surface of the original glass is ground and polished before treatment in a hydrogen environment. An effort is made to assess the thin film formation in terms of chemical bond variations that are postulated to exist in oxygen-deficient germanium-oxygen glasses. Author (GRA)

N72-19835# Aerospace Corp., El Segundo, Calif. Lab. Operations.
RESPONSE OF SUPERCONDUCTING POINT CONTACTS TO HIGH FREQUENCY RADIATION, JULY - DECEMBER 1970
Helmut Kanter and Frank L. Vernon, Jr. 5 Nov. 1971 13 p refs
(Contract F04701-71-C-0172)
(AD-734765; TR-0712(9230-20)-1; SAMSO-TR-71-326) Avail: NTIS CSCL 20/12

The high-frequency response predicted by a perturbation approach for a highly damped current driven Josephson junction agrees in its parameter dependence remarkably well with observations on point contacts used as video type detectors of microwave radiaiton. Author (GRA)

N72-19836# Minnesota Univ., Minneapolis. Physical Electronics Lab.
SURFACE STUDIES OF PHOTOEMISSIVE MATERIALS Final Report, 1 Nov. 1968 - 31 Oct. 1970
W. T. Peria Jun. 1971 177 p refs
(Contract DAAK02-69-C-0155)
(AD-734849) Avail: NTIS CSCL 20/12

Results of a photoelectric study of clean and cesiated Si(100) are presented and discussed. Both valence band and surface state emission was observed from the clean and cesiated silicon. The band bending at the silicon surface was determined as a function of cesium coverage. An apparatus was constructed to measure energy and angular distributions of secondary electrons. Results are presented demonstrating inelastic diffraction and characteristic losses. A preliminary study of surface inhomogenities due to heating GaAs is presented. A deconvolution technique for increasing the resolution of Auger electron spectra obtained with conventional analyzers is described. Author (GRA)

N72-19837# Army Electronics Command, Fort Monmouth, N.J.
SUPERCONDUCTIVE PRESSURE CONTACTS
J. J. Winter, J. T. Breslin, and G. K. Gaule Aug. 1971 38 p refs
(DA Proj. 1T0-61102-B-11-A)
(AD-734813; ECOM-3459) Avail: NTIS CSCL 09/1

Superconducting relays with a high critical current (100-200 A) capability have been shown to be practical. A study of weakly coupled pressure contacts was also made using an adaptation of the relay. Materials thought most likely to be effective as high critical current pressure contacts were tested. Oxidation of the contact surfaces reduced this effectiveness in some materials much more than it did in others. Preloading the contacts at room temperature was found to significantly increase the capacity to conduct high critical currents. The relationship of the critical current of the junction to its normal state resistance is investigated for Pb contacts. Various approximations to the effective contact area of Pb contacts are made and evaluated. Nb3Sn tape was tested as a contact material and found to conduct critical currents in excess of 100 A with good performance in applied magnetic fields. Author (GRA)

N72-19838# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
DATA COMPILATION OF VANADIUM OXIDES Interim Report
M. Neuberger Nov. 1971 66 p refs
(Contract DSA900-72-C-1182)
(AD-734596; EPIC-IR-79) Avail: NTIS CSCL 20/12

The change in crystal structure at the transition temperature in several of the vanadium oxides, causes a drastic change in resistivity as the material is heated (or cooled). This phenomenon is being applied to the manufacture of a number of devices. All available information on the crystal structure, physical, mechanical, thermal, optical, magnetic and electronic properties of bulk and film samples, has been tabulated in the compilation.
Author (GRA)

N72-19950*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SUPERCONDUCTING MAGNETS AND DEVICES FOR SPACE VEHICLES AND EXPERIMENTS
Eugene W. Urban *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 99-106 (See N72-19945 10-33)
Avail: NTIS CSCL 20C

N72-19484# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Avionics Lab.
MICROELECTRONICS FOR AEROSPACE SYSTEMS
H. V. Noble *In* AGARD Avionics in Spacecraft Sep. 1971 11 p refs (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

N72-19487# Communications Research Centre, Ottawa (Ontario).
AN IMPROVED APPROACH TO SELECTION OF HIGH RELIABILITY SEMICONDUCTOR COMPONENTS FOR SATELLITE PROGRAMS
A. R. Molozzi and R. F. Haythornthwaite *In* AGARD Avionics in Spacecraft Sep. 1971 7 p (See N72-19483 10-14)
Avail: NTIS HC $6.00/MF $0.95

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-19839# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe Lampoldshausen.
APPROXIMATE FUNCTIONS FOR THEORETICAL PERFORMANCE PARAMETERS OF THE ROCKET PROPELLANT COMBINATION LOZ/LHZ FOR COMBUSTION CHAMBER PRESSURES UP TO 400 BAR
H. J. Sternfeld and J. Reinkenhof 13 Dec. 1971 50 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-101) Avail: NTIS

Approximate functions in two variables are presented for theoretical performance parameters of the high-energy rocket propellant liquid oxygen/liquid hydrogen for equilibrium composition during expansion. Characteristic velocity, specific impulse, adiabatic combustion temperature, and the ratio of specific heats are presented as functions of mixture ratio and combustion chamber pressure. Specific impulse, optimum thrust coefficient, nozzle exit temperature, and nozzle area ratio are presented as functions of mixture ratio and expansion pressure ratio for a fixed combustion chamber pressure of 150 bar. The approximate functions are valid for oxidizer fuel mixture ratios from 2 to 12, combustion pressures from 20 bar to 400 bar, and expansion pressure ratios between 148 and 4500. Deviations of approximated data from the exact data were determined. Author

N72-19840# Utah Univ., Salt Lake City. Coll. of Engineering.
THE CHEMISTRY AND MECHANICS OF COMBUSTION WITH APPLICATION TO ROCKET ENGINE SYSTEMS Annual Report
M. L. Williams, R. H. Boyd, A. D. Baer, N. W. Ryan, and L. K. Isaacson Nov. 1971 135 p refs
(Contract F44620-68-C-0022)
(AD-734788; UTEC-TH-71-186; AFOSR-72-0008TR) Avail: NTIS CSCL 21/9

The purpose is to study the interdependence of combustion processes and the physico-mechanical behavior of solid fuel materials within the context of a rocket engine system. It is intended to capitalize upon a quantitative understanding of molecular structure, which affects both the combustion and mechanics behavior, and treat the propellant fuel and associated inert components as materials system--from processing, to a determination of the constitutive equation as needed to assess structural integrity, and failure under various environmental and loading conditions. Concurrently, several tasks are concerned with propellant as an energy source--from ignition through burning, gas dynamics, interaction with nozzle and insulation components, and consideration of electron noise and radar attenuation in the plume GRA

N72-19953*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADVANTAGEOUS USE OF SLUSH AND GELLED SLUSH IN SPACE VEHICLES
J. Z. Adamson *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 153-168 refs (See N72-19945 10-33)
Avail: NTIS CSCL 21I

N72-19954*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROPELLANT THERMAL STRATIFICATION
T. W. Winstead *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 169-178 refs (See N72-19945 10-33)
Avail: NTIS CSCL 21I

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-19841*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF RADIAL AND CIRCUMFERENTIAL INLET VELOCITY PROFILE DISTORTIONS ON PERFORMANCE OF A SHORT-LENGTH DOUBLE-ANNULAR RAM INDUCTION COMBUSTOR
Donald F. Schultz and Porter J. Perkins Washington Mar. 1972 43 p refs
(NASA-TN-D-6706; E-6464) Avail: NTIS CSCL 21A

Inlet air velocity profile tests were conducted on a full-scale short-length 102-centimeter-diameter annual combustor designed for advanced gas turbine engine applications. The inlet profiles studied include radial distortions that were center peaked, and tip peaked, as well as a circumferential distortion which was center peaked for one-third of the circumference and flat for the other two-thirds. An increase in combustor pressure loss was the most significant effect of the radial air velocity distortions. With the circumferential distortion, exit temperature pattern factor doubled when compared to a flat velocity profile. Author

N72-19842*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
LF460 DETAIL DESIGN
Sep. 1971 258 p refs
(Contract NAS2-6056)
(NASA-CR-120787; Doc-71-AEG-297) Avail: NTIS CSCL 21E

This is the final technical report documenting the detail design of the LF460, and advanced turbotip lift fan intended for application with the YJ97-GE-100 turbojet jet generator to a V/STOL transport research aircraft. Primary objective of the design was to achieve a low noise level while maintaining the high thrust/weight ratio capability of a high pressure ratio lift fan. Report covers design requirements and summarizes activities and final results in the areas of aerodynamic and mechanical design, component and system performance, acoustic features and final noise predictions. Author

N72-19843*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UPPER-LIMIT CHARGE EXCHANGE CROSS SECTIONS FOR MERCURY (PLUS) ON MOLYBDENUM AND CESIUM (PLUS) ON ALUMINUM
John V. Dugan, Jr. Washington Mar. 1972 19 p refs
(NASA-TM-X-2527; E-6728) Avail: NTIS CSCL 21C

Upper-limit charge exchange cross sections are calculated for Hg(+) on Mo and Cs(+) on Al. The cross sections are calculated from the polarization interaction at low ion energies (1 to 500 eV) and by assuming favorable curve crossings with a hard-core reaction radius at higher energies (500 eV to 10 keV). The cross sections for Hg(+) on Mo becomes greater than corresponding Hg Hg(+) resonance values at ion energies below 2 eV, whereas the Cs(+) Al values remain considerably lower than the Cs(+)Cs resonance value at all ion energies. It is also shown that charge exchange of slow Hg(+) with Mo may be important for spacecraft with electron bombardment thrusters. Author

N72-19844*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL EVALUATION OF HIGH-THRUST, THROTTLEABLE, MONOPROPELLANT HYDRAZINE REACTORS
Robert W. Riebling and Gerhard W. Kruger 1 Mar. 1972 30 p refs
(Contract NAS7-100)
(NASA-CR-125682; JPL-TR-32-1551) Avail: NTIS CSCL 21I

Throttleable monopropellant hydrazine catalytic reactors of a size applicable to a planetary landing vehicle were designed, fabricated, and tested. An experimental evaluation of two 2670-N reactor designs was conducted. The steady state and dynamic characteristics of the thruster/valve combinations were determined. The results of the testing, including the engine characteristic velocity, smoothness of combustion, insensitivity to heat sterilization, and response during various simulated duty cycles are presented and discussed. No problems of a fundamental nature were encountered as a result of rapid dynamic throttling of these large hydrazine reactors. Author

N72-19845*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE GENERATED BY QUIET ENGINE FANS. 1: FAN B
Francis J. Montegani Washington Mar. 1972 81 p refs
(NASA-TM-X-2528; E-6652) Avail: NTIS CSCL 21E

Acoustical tests of full scale fans for jet engines are presented. The fans are described and some aerodynamic operating data are given. Far field noise around the fan was measured for a variety of configurations over a range of operating conditions. Complete results of one third octave band analysis are presented in tabular form. Power spectra and sideline perceived noise levels are included. Author

N72-19846*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL DESIGN OF SERT 2 THRUSTER SYSTEM
Ralph J. Zavesky and Evert B. Hurst Washington Mar. 1972 34 p refs
(NASA-TM-X-2518; E-6630) Avail: NTIS CSCL 21H

The mechanical design of the mercury bombardment thruster that was tested on SERT is described. The report shows how the structural, thermal, electrical, material compatibility, and neutral mercury coating considerations affected the design and integration of the subsystems and components. The SERT 2 spacecraft with two thrusters was launched on February 3, 1970. One thruster operated for 3782 hours and the other for 2011 hours. A high voltage short resulting from buildup of loose eroded material was believed to be the cause of failure. Author

N72-19847*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID-PROPELLANT MOTORS FOR HIGH-INCREMENTAL-VELOCITY LOW-ACCELERATION MANEUVERS IN SPACE
John I. Shafer 1 Mar. 1972 95 p refs
(Contract NAS7-100)
(NASA-CR-125799; JPL-TM-33-528) Avail: NTIS CSCL 21H

The applicability of solid-propellant rockets into a regime of high-performance long-burning tasks beyond the capability of existing motors is discussed. Successful static test firings have demonstrated the feasibility of: (1) utilizing fully case-bonded end-burning propellant charges without mechanical stress relief; (2) using an all-carbon radiative nozzle markedly lighter than the flight-weight ablative nozzle it replaces, and (3) producing low spacecraft acceleration rates during the thrust transient through a controlled-flow igniter that promotes operation below the previous combustion limit. Author

N72-19848# Aerospace Corp., Los Angeles, Calif.
BASE FLOW ENVIRONMENT ANALYSIS OF A SINGLE ENGINE BOOSTER
Yong S. Hong Jul. 1972 12 p refs Revised Backup document for AIAA Synoptic scheduled for publication in Journal of Spacecraft and Rockets in Jul. 1972
(Contract F04701-70-C-0059)
(AIAA-Paper-71-643) Avail: NTIS

A method of predicting the base flow of an axially symmetric cylindrical vehicle with a single central jet issuing from the base has been developed. Some of the flow variables that can be estimated by this method are base pressure, base gas temperature, and entrainment rate of ambient air into the base region. Effect of vehicle and nozzle geometry, engine operating conditions, vehicle trajectory, and base mass bleed on base pressure and gas temperature has been studied parametrically. The base pressures obtained by the present method agree well with Thor flight data as well as available wind tunnel data. The method is limited to a case where the mixing layer is fully turbulent and both the external freestream and the central jet stream are supersonic. Author

N72-19849*# Pratt and Whitney Aircraft, East Hartford, Conn.
STUDY OF AERODYNAMIC NOISE IN LOW SUPERSONIC OPERATION OF AN AXIAL FLOW COMPRESSOR Final Report
R. A. Arnoldi 5 Mar. 1972 80 p refs
(Contract NASw-2249)
(NASA-CR-125811; PWA-4411) Avail: NTIS CSCL 21E

A study of compressor noise is presented, based upon supersonic, part-speed operation of a high hub/tip ratio compressor designed for spanwise uniformity of aerodynamic conditions, having straight cylindrical inlet and exit passages for acoustic simplicity. Acoustic spectra taken in the acoustically-treated inlet plenum, are presented for five operating points at each of two speeds, corresponding to relative rotor tip Mach numbers of about 1.01 and 1.12 (60 and 67 percent design speed). These spectra are analyzed for low and high frequency broadband noise, blade passage frequency noise, combination tone noise and 'haystack' noise (a very broad peak somewhat below blade passage frequency, which is occasionally observed in engines and fan test rigs). These types of noise are related to diffusion factor, total pressure ratio, and relative rotor tip Mach number. Auxiliary measurements of fluctuating wall static pressures and schlieren photographs of upstream shocks in the inlet are also presented and related to the acoustic and performance data. Author

N72-19850# Technische Hochschule Munchen (West Germany). Inst. fuer Raumfahrttechnik.
ON THE THEORY OF HYBRID PROPELLANTS [ZUR THEORIE VON HYBRIDTRIEBWERKEN]
R. Schmucker Cologne DGLR 1971 27 p refs In GERMAN Presented at the 4th DGLR Ann. Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The design and optimization of hybrid propellant rocket engines are discussed. The operating conditions are determined by the disintegration of the solid propellant under the influence of the oxidizer. In this process the combustion chamber pressure, the mixing ratio, and the exhaust velocity change. In order to find an exact solution to this problem, a linearized theory was developed based on quasi-steady conditions. The resulting relationships are used to investigate the most important propellant compositions. The optimal design of a spacecraft with hybrid propulsion was studied. ESRO

N72-19851# Technische Hochschule in Graz (Austria). Inst. fuer Thermische Turbomaschinen.
OPERATIONAL CRITERIA FOR JET PIPES WITH PULSATING COMBUSTION [BETRIEBSKRITERIEN FUER STRAHLROHRE MIT PULSIERENDER VERBRENNUNG]
G. Zhuber-Okrog Cologne DGLR 1971 15 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The combustion physics and operational requirements of jet pipes with pulsating combustion are discussed. For high pressure amplitudes the combustion should take place at the closed end of the pipe. An open end is always necessary for suction of fresh fuel, and the formation of a steep delaying pressure wave for introduction of ignition. Intake resistance or counterpressure, appearing as suction force at the open pipe end, is necessary to keep the fuel mixture within the correct limits. Pipe length has to be a multiple of the pipe diameter, so that the time available for combustion is sufficient. ESRO

N72-19852# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche (France).
STUDY OF THE COMPRESSION CAPACITY OF AXIAL COMPRESSORS [CONTRIBUTION A L'ETUDE DU TASSEMENT DES COMPRESSEURS AXIAUX]
J. M. Thiaville 1971 39 p refs In FRENCH Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The squeezing of chords and gaps is studied as a method of increasing the compression ratio by length unit in axial compressing. Two three-stage transonic compressors were tested. The decrease in chord was balanced by a proportional increase of blades. Test results for through-flow, efficiency, and surge limit, are presented and analyzed for the two compressors over the full range of rotation velocities. The effect of adding fins on the rotor wheels of compressor 2 is discussed. A complete computation of the flow through both compressors leads to a better knowledge of aerodynamical effects of the squeezing. ESRO

N72-19853# TRW Systems Group, Redondo Beach, Calif. Electric Propulsion Dept.
EXPLORATORY DEVELOPMENT OF ADVANCED COLLOID THRUSTERS Technical Report, 15 May 1970 - 15 Sep. 1971
M. Huberman, C. Lear, H. Shelton, W. Krieve, and R. Kemp Edwards AFB, Calif. AFRPL Nov. 1971 315 p refs
(Contract F33615-70-C-1405)
(AD-734248; AFRPL-TR-71-128) Avail: NTIS CSCL 21/3

The report describes a program to develop high performance colloid thruster systems. An electrostatically vectorable high thrust-density colloid source was developed and endurance tested for periods up to 2000 hours. The investigation of pulsed colloid thruster technology resulted in a demonstration of a feasible concept. Also, a breadboard high voltage supply for a pulsed thruster was built and demonstrated as well as a high voltage isolation valve to electrically decouple the propellant storage system from an individual thruster. Author (GRA)

N72-19854# Pratt and Whitney Aircraft, East Hartford, Conn.
FAN-COMPRESSOR NOISE: PREDICTION, RESEARCH, AND REDUCTION STUDIES Final Report, 9 Jan. 1969 - 29 Jan. 1971
E. A. Burdsall and R. H. Urban Feb. 1971 406 p refs
(Contract DOT-FA69WA-2045)
(AD-733590; PWA-4154; FAA-RD-71-73) Avail: NTIS CSCL 20/1

A study of fan and compressor noise was undertaken for the development of an accurate prediction system, based on theoretical concepts and/or empirical data, which would enable the selection of proper acoustical design choices for future engines. Experimental programs were conducted using a variety of test rigs to provide acoustic data and to validate theoretical concepts. Mathematical models were developed for each type of fan noise, and their applicability to actual engines was evaluated. The material presented represents significant progress in the understanding of particular noise-generating mechanisms and the capability to predict fan noise. Author (GRA)

N72-19855# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF A DIFFUSER ON THE CHARACTERISTIC OF STABLE OPERATION OF A CENTRIFUGAL COMPRESSOR STAGE
N. L. Zeldes 12 Jul. 1971 19 p refs Transl. into ENGLISH

from Dvigateli Vnutr. Sgoraniya, Sb. Rabot (Moscow), no. 8, 1969 p 135-143
(FTD Proj. 6040102)
(AD-730042; FTD-HT-23-795-71) Avail: NTIS CSCL 21/7

Experimental results are presented from studies of stages of centrifugal compressors with different diffusors in relation to geometric characteristics of channels and grids with the number of vanes and vane placement angle are varied. A well defined analytic relationship has been established between the onset of flow separation with the moment of equality of the average flow angle at the outlet from the ring with intake angles of diffusor vane placement. Recording of the moment of onset of separation by oscillography and study of flow formation in the gap behind the ring with a pneumo probe confirmed the conclusion of constancy of flow angle in separation independently of rotor revolutions and affords tracking the analytic and experimental limits of separation for satisfactory agreement. GRA

N72-19856# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTACTLESS MEASUREMENT OF THE TIP CLEARANCE IN JET ENGINE TURBINE
J. Lewitowicz 19 Oct. 1971 12 p refs Transl. into ENGLISH from Inst. Tech. Wojsk Lotniczych (Warsaw), 1968 p 151-153
(FTD Proj. AAH9)
(AD-734912; FTD-HC-23-1092-71) Avail: NTIS CSCL 21/5

A description of a new method of contactless measurement of the tip clearance in a jet engine turbine, based on the properties of radioactive isotopies is shown. This method makes it possible to determine tip clearance in a jet engine during operation, making it possible to determine clearance changes at various times between overhauls. This method is also useful for measuring radial clearance between any rotating element and its housing. Author (GRA)

N72-19857# Bendix Corp., South Bend, Ind. Energy Controls Div.
ELECTRONIC ENGINE CONTROL UTILIZING COMPRESSOR EXIT CONDITIONS FOR ACCELERATION CONTROL Final Report, Jun. 1970 - Jul. 1971
Samuel E. Arnett 15 Oct. 1971 230 p refs
(Contract F33615-70-C-1503; AF Proj. 3066)
(AD-734542; ECD-863-18127-R; AFAPL-TR-71-78) Avail: NTIS CSCL 21/5

The document is the final report of a one-year research and development effort starting June 1970, to determine the feasibility and the general applicability of fuel flow control by sensing the airflow conditions at the discharge of the engine compressor. Author (GRA)

N72-19858# Naval Postgraduate School, Monterey, Calif.
PROCEEDINGS OF THE WORKSHOP ON FLOW IN TURBOMACHINES
Michael H. Vavra, Kyriacos D. Papailiou, and James R. Woods, Jr. 16 Nov. 1971 441 p refs Conf. held at Monterey, Calif., Dec. 1970
(AD-735021; NPS-57VA1111A) Avail: NTIS CSCL 21/5

Contents: Non-steady phenomena in transonic and supersonic flows and possible methods of solution; Some recent developments in the numerical analysis and simulation of fluid turbulence; A review of the history of boundary layer calculation methods and the present state of the art; New measuring and flow-visualization techniques; Applicability of cascade test data to design methods; Radial equilibrium across a normal shock in an axial rotor; Three-dimensional, inviscid flow analysis in turbomachinery; Application of results of research to engine design problems; Loss evaluation methods in axial-flow compressors; The turbulence structural hypothesis and loss coefficient predictions; Loss correlations and off-design performance predictions; Flutter; Noise; Stall and surge; and Turbine blade cooling GRA

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-19859 National Lending Library for Science and Technology, Boston Spa (England).
STORMS AND SOLAR ACTIVITY
G. G. Kuzminskaja [1971] 3 p Transl. into ENGLISH from Priroda (Moscow), no. 3, 1971 p 125
(NLL-M-22071-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A series of sea distrubance observations was analyzed for the Black Sea. A quasi-periodicity was noticed in the sense of calm and stormy years. The period of observation included the years from 1952 to 1969. Data based on world-wide observations suggest that a periodicity of 10 to 12 years can be traced globally and is related to solar activity which has an 11-year cycle. K.P.D.

N72-19860*# California Univ., La Jolla. Dept. of Applied Physics and Information Science.
COLLISIONLESS SOLAR WIND PROTONS: A COMPARISON OF KINETIC AND HYDRODYNAMIC DESCRIPTIONS
Egil Leer and Thomas E. Holzer (NOAA, Boulder, Colo.) [1971] 23 p refs
(Grant NGR-05-009-081)
(NASA-CR-125802) Avail: NTIS CSCL 03B

Kinetic and hydrodynamic descriptions of a collisionless solar wind proton gas are compared. Heat conduction and viscosity are neglected in the hydrodynamic formulation but automatically included in the kinetic formulation. The results of the two models are very nearly the same, indicating that heat conduction and viscosity are not important in the solar wind proton gas beyond about 0.1 AU. It is concluded that the hydrodynamic equations provide a valid description of the collisionless solar wind protons, and hence that future models of the quiet solar wind should be based on a hydrodynamic formulation. Author

N72-19861*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 100,000 PULSE HEIGHT ANALYZER FOR USE IN HIGH ENERGY COSMIC RAY EXPERIMENTS (HECRE) ON HIGH ALTITUDE BALLOON FLIGHTS
Ciro A. Cancro, Norman M. Garrahan, and Richard G. McGowan Dec. 1971 24 p refs
(NASA-TM-X-65836; X-711-71-500) Avail: NTIS CSCL 03B

A description is given of a wide dynamic range pulse height analyzer system developed for use on High Energy Cosmic Ray Experiment (HECRE) Balloon Flights. A wide dynamic range of 100,000 is obtained by extending the range of a basic 1024 channel analyzer through the use of multiple ranges and range selection. The system described here contains four 100,000 pulse height analyzers. Each 100,000 pulse height analyzer consists of a group of cordwood welded modules mounted and interconnected on a printed circuit card. Four of these card assemblies, the required clock drive circuitry (discrete components mounted and interconnected on a separate card) and three input-output connectors are interconnected and mounted on the system board. Author

N72-19862*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC RAY PROTON AND HELIUM SPECTRA ABOVE 50 GeV
M. J. Ryan, J. F. Ormes, and V. F. Balasubrahmanyan Mar. 1972 13 p refs Submitted for publication

(NASA-TM-X-65850; X-661-72-66) Avail: NTIS CSCL 03B

Differential energy spectra of cosmic ray protons and helium nuclei were measured by an ionization spectrometer flown at balloon altitudes. The energy range extended from 50 GeV to above 1000 GeV. The observed differential intensities can be represented with power law spectra with a slope of -2.75 + or - 0.03 for protons and of -2.77 + or - 0.55 for helium nuclei. The proton to helium ratio is equal to 26 + or - 3 at 40 GeV/nuc and is constant within errors up to 400 GeV/nuc. Author

N72-19863# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.

ELECTRON-PRODUCTION RATE OF SOLAR AND GALACTIC COSMIC RAYS IN THE LOWER IONOSPHERIC D-REGION Research and Development Report, Aug. 1969 - Jun. 1970

Paul E. Argo 11 Aug. 1971 30 p refs

(AD-734390; NELC-TR-1783) Avail: NTIS CSCL 04/1

The heavy-ion component of galactic cosmic rays is found to yield an electron-production rate approximately one-half the magnitude of the proton component. At high altitudes, variations in the cut-off energy level in the middle and high geomagnetic latitudes (physically caused by geomagnetic storms) have a large effect on the electron-production rate of galactic cosmic rays (especially in the transition region between cut-off and no effective cut-off (approximately 68 degrees); in the 30-to-60-km altitude region, however, electron production is not significantly affected. Solar protons can cause an abnormally high electron-production rate (at high latitudes) to all depths of the ionosphere, indicating a large effect on VLF reflection during solar particle storms. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-19864*# Lockheed Missiles and Space Co., Palo Alto, Calif.

UV AND RADIOFREQUENCY OBSERVATIONS OF WOLF-RAYET STARS

Hugh M. Johnson 1971 21 p refs Presented at Symp. 49 of the Intern. Astron. Union

(Contract NASw-1977)

(NASA-CR-125691) Avail: NTIS CSCL 03A

Observations of W stars in the ultraviolet by OAO 2 and at 750 and 1400 MHz with the Green Bank telescopes are discussed. The emphasis is on the Green Bank observations of W stars with symmetric nebulae around them, their interpretation, and comparisons with other data. The implications regarding mass distribution, internal motion, flux density, ejected mass, velocity dispersion, and expanding envelopes are considered in detail. N.E.N.

N72-19865*# Lockheed Missiles and Space Co., Palo Alto, Calif.

THE UV SPECTRUM OF THE CRAB NEBULA

Hugh M. Johnson 1971 10 p refs Presented at Symp. on Sci. Results from OAO-2, Amherst, Mass., 23-24 Aug. 1971

(Contract NASw-1977)

(NASA-CR-125692) Avail: NTIS CSCL 03A

Observations of the Crab nebula are described, which were made under the OAO 2/NASA guest-investigator program with WEP stellar photometers. The 10 foot-diameter focal plane diaphragm was ample enough to accept the 4 ft X 6 ft image. The logarithm of the integrated relative intensity per wavelength interval, corrected for sky background, and the rms error, from 11 passbands in the range 4250 to 1380 A, are given. No correction was given for polarization of light. The data were converted to logarithm of the flux density per frequency interval and plotted on scales of log nu (Hz) and of reciprocal microns with two adjustments. Author

N72-19866*# Texas Univ., Austin. Electrical Engineering Research Lab.

PLANETARY OBSERVATIONS AT MILLIMETER WAVELENGTHS

B. L. Ulich, J.R. Cogdell, and J. H. Davis 31 Jan. 1972 100 p refs

(Grant NGL-44-012-006)

(NASA-CR-125849; NGL-006-72-1) Avail: NTIS CSCL 03A

Observations of the Sun, Moon, Mercury, Venus, Mars, Jupiter, and Saturn were made at 3.1 mm and 8.6 mm wavelengths with a 16-foot radio telescope between March and August, 1971. Absolute brightness temperature data are given. All errors are one standard deviation and include uncertainties in antenna gain calibration. The solar and lunar temperatures are in excellent agreement with published observations. The planetary measurements at 3.1 mm are consistently higher than previous results. The implications of higher temperatures with respect to existing atmospheric and surface models are discussed. Author

N72-19867*# Lockheed Missiles and Space Co., Huntsville, Ala.

THE APPLICATION OF OPTIMAL CONTROL TECHNIQUES TO ADVANCED MANNED MISSIONS, VOLUME 1 Final Report, May 1970 - Feb. 1972

C. L. Connor and W. Trautwein Feb. 1972 68 p refs 2 Vol.

(Contract NAS8-25578)

(NASA-CR-123560; LMSC-HREC-D225541-1-Vol-1; HREC-5578-1-Vol-1) Avail: NTIS CSCL 22A

Two problems are presented in the area of optimal control and its application to the design of attitude control systems for advanced complex aerospace vehicles. The problems discussed are specification of performance criteria in terms of structural load minimization and/or maximum orbital payload injection requirements of the controlled vehicle; and formulation and solution of the optimization problem such that practical control systems are obtained. Author

N72-19868*# Lockheed Missiles and Space Co., Huntsville, Ala.

THE APPLICATION OF OPTIMAL CONTROL TECHNIQUES TO ADVANCED MANNED MISSIONS, VOLUME 2 Final Report, May 1970 - Feb. 1972

C. L. Connor and W. Trautwein Feb. 1972 177 p 2 Vol.

(Contract NAS8-25578)

(NASA-CR-123561; LMSC-HREC-D225541-2-Vol-2; HREC-5578-1-Vol-2) Avail: NTIS CSCL 22A

The hybrid optimization techique for attitude control design is described in detail. The technque is capable of optimizing an n-dimensional adjustable parameter vector, but a 1-dimensional vector is used as an example to explain the procedure. This permits an easier explanation as opposed to a multidimensional case. The procedure used to derive the perturbation equations of motion describing the 6-DOF shuttle ascent phase is presented. These equations were programmed on the EAI 8800 analog computer to describe the perturbations of the shuttle vehicle from a nominal zero lift trajectory due to wind disturbances. Included are the control system equations, trim equations, and wind angle of attack equations. Analog wiring diagrams, raw data and time-varying coefficients, and state variable responses during shuttle ascent are also considered. Author

N72-19869*# Techtran Corp., Glen Burnie, Md.

SPACE DEVELOPMENT IN EUROPE AND THE UNITED STATES OF AMERICA WITH EMPHASIS ON THE POST-APOLLO PROGRAM

Tetsuya Chiga Washington NASA Mar. 1972 105 p Transl. into ENGLISH of Rept. no. 110 of the Long-Range Space

Program Study Team, Federation of Econ. Organ., Tokyo, Nov. 1971 114 p
(Contract NASw-2037)
(NASA-TT-F-14114) Avail: NTIS CSCL 05A

The long range space programs study team visited various NASA facilities and centers to discuss the post-Apollo program (space shuttle, space tug, Skylab, Viking). They also surveyed European programs. It was concluded that there is still an opportunity for Japan to cooperate in the space program.

Author

N72-19870# National Research Council of Canada, Ottawa (Ontario). Radio and Electrical Engineering Div.
CATALOG OF RADIO OBSERVATIONS OF PLANETARY NEBULAE AND RELATED OPTICAL DATA
L. A. Higgs Dec. 1971 457 p
(NRC-12129; PAB-Vol-1-NO-1) Avail: NTIS

All radio observations of the total flux density of planetary nebulae, in the literature up to 1971, are presented in catalog form. For each nebula included in the catalog, morphological parameters, observations of Balmer line (H alpha and H beta) fluxes, and physical parameters derived from the radio and optical data are listed. The latter quantities are obtained by fitting model nebulae to the observed radio spectra and by assuming that all nebulae have the same ionized mass (i.e., using the Shklovskii method).

Author

N72-19871*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A MULTIPLE-IMPULSE FUNCTION FOR ORBITAL TRANSFER AND ITS DERIVATIVES
James F. Kibler and Lawrence H. Hoffman Washington Mar. 1972 25 p refs
(NASA-TM-X-2492; L-8106) Avail: NTIS CSCL 22A

A multiple-impulse function is represented as a sequence of single-impulse functions. The single-impulse transfer which yields the velocity change required to transfer from a specified initial orbit to a partially specified final orbit is developed. Analytic derivatives of the function are obtained for use in optimization techniques. A four-impulse transfer is outlined. The analytic derivatives may allow more efficient optimization than numerical derivatives do.

Author

N72-19872*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIMULTANEOUS IMPACT AND LUNAR CRATERS
Verne R. Oberbeck Mar. 1972 15 p refs
(NASA-TM-X-62141) Avail: NTIS CSCL 03B

The existence of large terrestrial impact crater doublets and crater doublets that have been inferred to be impact craters on Mars suggests that simultaneous impact of two or more bodies can occur at nearly the same point on planetary surfaces. An experimental study of simultaneous impact of two projectiles near one another shows that doublet craters with ridges perpendicular to the bilateral axis of symmetry result when separation between impact points relative to individual crater diameter is large. When separation is progressively less, elliptical craters with central ridges and peaks, and circular craters with deep round bottoms are produced. These craters are similar in structure to many of the large lunar craters. Results suggest that the simultaneous impact of meteoroids near one another may be an important mechanism for the production of central peaks in large lunar craters.

Author

N72-19873*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF MULTIPLE ENCOUNTERS ON SHORT PERIOD COMET ORBITS
Barbara E. Lowrey Feb. 1972 35 p refs Submitted for publication
(NASA-TM-X-65839; X-553-72-32) Avail: NTIS CSCL 03C

The observed orbital elements of short period comets are found to be consistent with the hypothesis of derivation from long period comets as long as two assumptions are made. First, the distribution of short period comets has been randomized by multiple encounters with Jupiter and second, the short period comets have lower velocities of encounter with Jupiter than is generally expected. Some 16% of the observed short period comets have lower encounter velocities than is allowed mathematically using Laplace's method. This may be due to double encounter processes with Jupiter and Saturn, or as a result of prolonged encounters. The distribution of unobservable short period comets can be inferred in part from the observed comets. Many have orbits between Jupiter and Saturn with somewhat higher inclinations than those with perihelions near the earth. Debris from those comets may form the major component of the zodiacal dust.

Author

N72-19874*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GALAXY FORMATION FROM ANNIHILATION-GENERATED SUPERSONIC TURBULENCE IN THE BARYON-SYMMETRIC BIG-BANG COSMOLOGY AND THE GAMMA RAY BACKGROUND SPECTRUM
F. W. Stecker and J. L. Puget (Observatoire de Paris, France) Feb. 1972 39 p refs Submitted for publication
(NASA-TM-X-65841; X-641-72-62) Avail: NTIS CSCL 03B

Following the big-bang baryon symmetric cosmology of Omnes, the redshift was calculated to be on the order of 500-600. It is show that, at these redshifts, annihilation pressure at the boundaries between regions of matter and antimatter drives large scale supersonic turbulence which can trigger galaxy formation. This picture is consistent with the gamma-ray background observations discussed previously. Gravitational binding of galaxies then occurs at a redshift of about 70, at which time vortical turbulent velocities of about 3 x 10 to the 7th power cm/s lead to angular momenta for galaxies comparable with measured values.

Author

N72-19875# Texas Univ., Austin. Dept. of Astronomy.
PROPERTIES OF COMMERCIAL ELECTRON-SENSITIVE PLATES FOR ASTRONOMICAL ELECTRONOGRAPHY
P. Griboval, D. Griboval, M. Marin, and J. Martinez [1971] 28 p refs
(Grants NSF GP-13697; NSF GP-24488)
Avail: NTIS

The characteristic curves and detective quantum efficiency of plates useful for astronomical electronography were studied, under an appropriate range of variables. After a preliminary investigation, the study was restricted to four types of emulsions already used in astronomical work, namely Kodak NTB 2 and Ilford G5, K5 and L4, all 10 microns thick. The characteristic curves and absolute sensitivities yielded fairly consistent results. Noise and resolution studies are discussed, pointing out the difficulties of measurement.

Author

N72-19876*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
EARTH ORBITING SISYPHUS SYSTEM STUDY Final Report
Igor Jurkevich, Kurt W. Krause, Sherman L. Neste, and Robert K. Soberman Oct. 1971 175 p refs
(Contract NAS1-10158)
(NASA-CR-112024) Avail: NTIS CSCL 03A

The feasibility of employing an optical meteoroid detecting system, known as Sisyphus, to measure the near-earth particulates from an earth orbiting vehicle, is considered. A Sisyphus system can discriminate between natural and man-made particles since the system measures orbital characteristics of particles. A Sisyphus system constructed for the Pioneer F/G missions to Jupiter is used as the baseline, and is described. The amount of observing time which can be obtained by a Sisyphus instrument launched into various orbits is determined. Observation time is lost when, (1) the Sun is in or near the field of view, (2) the lighted Earth is in or near the field of view, (3) the

instrument is eclipsed by the Earth, and (4) the phase angle measured at the particle between the forward scattering direction and the instrument is less than a certain critical value. The selection of the launch system and the instrument platform with a dedicated, attitude controlled payload package is discussed. Examples of such systems are SATS and SOLRAD 10(C) vehicles, and other possibilities are AVCO Corp. S4 system, the OWL system, and the Delta Payload Experiment Package.
Author

N72-19877*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON RECONSTRUCTING TRAJECTORIES IN THE VENUS LOWER ATMOSPHERE
P. Argentiero and G. Wyatt Feb. 1972 21 p refs Submitted for publication
(NASA-TM-X-65847; X-551-72-47) Avail: NTIS CSCL 22C

A Monte Carlo technique was utilized in order to demonstrate the feasibility of processing in situ measurements of temperature, pressure, and molecular weight. The technique assumes that the lower atmosphere of Venus obeys the ideal gas law and the hydrostatic equation. Time correlations are assumed to exist in the data. It is shown that the errors in trajectory reconstruction are due mostly to noise in the data rather than to inaccuracies in the numerical technique. Author

N72-19878*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A GUIDE TO USING METEOROID-ENVIRONMENT MODELS FOR EXPERIMENT AND SPACECRAFT DESIGN APPLICATIONS
Donald J. Kessler Washington Mar. 1972 35 p refs
(NASA-TN-D-6596; MSC-S-273) Avail: NTIS CSCL 03B

A method was derived for transforming a meteoroid flux, defined relative to the earth and expressed as a function of meteoroid mass, velocity, and mass density into a meteoroid flux expressed as a function of penetration thickness (or some other parameter) on a moving spacecraft at some particular distance from the earth. The procedure for performing the transformation is summarized and an example is discussed. Author

N72-19879*# National Aeronautics and Space Administration, Washington, D.C.
ON THE MOON WITH APOLLO 16: A GUIDEBOOK TO THE DESCARTES REGION
Gene Simmons Apr. 1972 95 p refs
(NASA-EP-95) Avail: NTIS; SOD $1.00 CSCL 22C

This guidebook gives in simple terms information about the Apollo 16 mission of scientific exploration of the Descartes region of the Moon. Author

N72-19880*# Translation Consultants, Ltd., Arlington, Va.
SPACE DUST ADHESION
B. A. Trubnikov Washington NASA Mar. 1972 4 p refs Transl. into ENGLISH from Priroda (USSR), no. 8, Aug. 1971 p 76-77
(Contract NASw-2038)
(NASA-TT-F-14151) Avail: NTIS CSCL 03B

Adhesion of particles and the independence of final structures from initial distributions are discussed. A simple mechanism for the adhesion of space dust is described. Author

N72-19881*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER EXPERIMENTS ON THE STRUCTURE AND DYNAMICS OF SPIRAL GALAXIES
Frank Hohl Washington Mar. 1972 52 p refs
(NASA-TN-D-6630; L-8109) Avail: NTIS CSCL 03A

The evolution of an initially balanced rotating disk of stars with an initial velocity dispersion given by Toomre's local criterion was investigated by means of a computer model for isolated disks of stars. It was found that the disk is unstable against very large scale modes. A stable axisymmetric disk with a velocity dispersion much larger than that given by Toomre's criterion was generated. The final mass distribution for the disk gives a high density central core and a disk population of stars that is closely approximated by an exponential variation. Various methods and rates of cooling the hot axisymmetric disks were investigated. It was found that the cooling resulted in the development of two-arm spiral structures which persisted as long as cooling continued. An experiment was performed to induce spiral structure in a galaxy by means of the close passage of a companion galaxy. Parameters similar to those expected for M51 and its companion were used. It was found that because of the high velocity dispersion of the disturbed disk galaxy, only a weak two-arm spiral structure appeared. The evolution of a uniformly rotating disk galaxy which is a stationary solution of the collisionless Boltzmann equation was investigated for various values of the initial rms velocity dispersion. It was found that the disk becomes stable at a value of the velocity dispersion predicted by theory. Author

N72-19882# Royal Greenwich Observatory, Herstmonceux (England).
MOTION OF AO STARS PERPENDICULAR TO THE GALACTIC PLANE. PART 5: (U, B, V) PHOTOMETRY OF A STARS IN THE SOUTH GALACTIC CAP
J. B. Alexander and B. S. Carter 1971 12 p refs *Its* Roy. Obs. Bull. No. 169 Prepared jointly with Roy. Obs., Capetown
Avail: NTIS; Roy. Greenwich Obs., Herstmonceux: £0.20

UBV photometry data are presented for 165 A stars in the south galactic cap. For the majority of these stars, radial velocities and MK spectral types were published previously. It appears that the mean interstellar reddening in the direction of the south galactic cap is small. Author (ESRO)

N72-19883# European Space Operations Center, Darmstadt (West Germany).
ACCURACY ESTIMATION FOR SPACECRAFT POSITION AND VELOCITY
H. G. Walter May 1971 38 p refs
(ESRO-SR-16-ESOC) Avail: NTIS

A mathematical method was developed, by means of which the potential standard deviations of the elements and the position and velocity vectors of a spacecraft orbit are determined. The weighted least-squares principle was adopted to establish the covariance matrices of the orbital elements and the state vector. Allowance is made in the model for dealing simultaneously with different types of observations, by attributing proper weighting factors. The observational data divide into the angular and range measurements, and the corresponding rate measurements. Random and systematic errors in the tracking observations and of systematic errors of the station locations are considered. Author (ESRO)

N72-19884# Mons Univ. (Belgium). Dept. of Astrophysics.
[ACTIVITIES OF THE ASTROPHYSICAL DEPARTMENT] Annual reports, 1969, 1970, and 1971
L. Houziaux 1972 13 p refs
(Commun-19) Avail: NTIS

Among the topics covered are the optical, photographic and computing equipment, library, teaching activities, research activities into stellar atmospheres and infrared spectra of novae and Be stars, and observing facilities. ESRO

N72-19885# Massachusetts Univ., Amherst. Dept. of Physics and Astronomy.
MEASUREMENT OF THE OBLATENESS OF THE DISK OF THE SUN Final Report, 1 Mar. 1970 - 31 Aug. 1971
H. Mark Goldenberg 22 Sep. 1971 23 p refs
(Contract F19628-70-C-0199; AF Proj. 7649)
(AD-734049; AFCRL-71-0497) Avail: NTIS CSCL 03/1

The report covers the period March 1, 1970 through

August 31, 1971 within which construction at the University of Massachusetts of a new instrument for the measurement of the solar oblateness was initiated and completed. Initial operation of the instrument commenced in May, 1971 and the first summer season was devoted to perfecting the telescope and its associated control electronics. A review of the current theoretical status of the oblate sun is contained herein, including discussion of the significance of some recent experimental results apparently inconsistent with a significant solar mass quadrupole moment. A description of the characteristics of the new instrument and a summary of the first summer of operation are also included. Author (GRA)

N72-19886# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
MATHEMATICAL METHODS APPLIED TO THE MOTION OF SATELLITES AND RELATED PROBLEMS IN GEODESY Annual Technical Report, 1 Nov. 1970 - 31 Oct. 1971
G. E. O. Giacaglia and B. D. Tapley 1 Nov. 1971 8 p refs
(Contract N00014-67-A-0126-0013)
(AD-734023; ATR-2) Avail: NTIS CSCL 22/3

The report contains new mathematical methods in orbital mechanics. Approximation theory and differential equations are developed. Author (GRA)

N72-19887# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE MOTION OF BALLISTIC MISSILES
L. S. Glover and J. C. Hagen Jul. 1971 358 p refs
(Contract N00017-62-C-0604)
(AD-731662; APL-TG-1164) Avail: NTIS CSCL 16/2

The handbook on the motion of ballistic missiles has been prepared primarily for use in training new personnel charged with the responsibility of evaluating the performance of reentry bodies. Aerodynamic fundamentals and characteristics of the atmosphere are reviewed briefly, followed by discussions of the effects on ballistic missile motion of gravity, earth rotation, the atmosphere, and initial body rates. The anomalous motion resulting from various types of mass and/or aerodynamic asymmetries is discussed in detail. Simple solutions are given for the impact dispersion resulting from asymmetries and nonstandard meteorological characteristics at the impact location. Various trajectory simulations and flight test analyses are also discussed. Numerical examples illustrate the material. Author (GRA)

N72-19888# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RENDEZVOUS IN ORBIT
A. A. Lebedev and V. B. Sokolov 30 Aug. 1971 505 p refs Transl. into ENGLISH of the book "Vstrecha na Orbit" Moscow, Izd-vo Mashinostroyeniye, 1969 p 1-366
(AF Proj. 4160)
(AD-734355; FTD-MT-24-26-71) Avail: NTIS HC $6.00/MF $0.95 CSCL 22/1

The book contains systematized and generalized materials on the theoretical and experimental investigations of rendezvous and docking of space vehicles in orbit. The areas of application and the basic stages of rendezvous are examined. Possible maneuvers and trajectories are given for placing space vehicles in the rendezvous zone, and also methods of synthesis of these trajectories and methods of guidance which are necessary for placing a vehicle on intermediate orbits and directly in the rendezvous zone. Author (GRA)

N72-19889# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
IR STARS: SEARCH FOR 3.5 mm RADIATION AND TENTATIVE DETECTION OF VY CMa Technical Report, Oct. - Nov. 1970
W. J. Wilson 15 Aug. 1971 15 p refs
(Contract F04701-71-C-0172)
(AD-733333; TR-0172(2230-20)-4; SAMSO-TR-71-262) Avail: NTIS CSCL 03/2

A search has been made for 3.5-mm radiation from twelve IR stars with strong 10-micron radiation. The sources VY CMa and IRC - 10216 were tentatively detected with 3.5-mm fluxes of 0.2 plus or minus 0.07 (sigma) f.u. and 0.4 plus or minus 0.2 f.u., respectively. The IRC - 10216 result is consistent with a measurement by Kellermann and Pauliny-Toth. If the 3.5-mm radiation comes from an optically thick circumstellar region having the IR temperature of 600 degrees K, this region would have a linear dimension of about 100 a.u. Author (GRA)

N72-19890# Harvard Coll. Observatory, Cambridge, Mass.
ASTROPHYSICAL OBSERVATIONS OF POLARIZED STARS AND NEBULAE Final Report, 1 Apr. 1968 - 30 Jun. 1971
William Liller Aug. 1971 10 p
(Contract F19628-68-C-0228; AF Proj. 8608)
(AD-733424; AFCRL-71-0452) Avail: NTIS CSCL 03/2

In the last 39 months, numerous measurements of the degree of optical polarization of the light emitted by a wide variety of astronomical sources have been made. These data have led to a better understanding of the surface properties of asteroids and satellites, of the nature of the interstellar grains, and the characteristics of planetary nebulae, quasars, and pulsars. The results have been extended by observations of other types, primarily spectrographic. Author (GRA)

N72-19891# Denver Univ., Colo. Dept. of Physics.
NON-STELLAR CELESTIAL BACKGROUNDS Final Report, 26 May 1970 - 30 Apr. 1971
David G. Murcray, Frank H. Murcray, Robert C. Amme, Jack G. Hewitt, Jr., and D. Boyd Barker Jul. 1971 102 p refs
(Contract F19628-70-C-0286; AF Proj. 7670)
(AD-733708; AFCRL-71-0424) Avail: NTIS CSCL 03/2

Part 1 - The spectral emissivity of several lunar surface features as measured during two balloon flights are reported. The wavelength of the peak emissivity is found to differ among the surface features investigated. After the two flights reported the spectrometer utilized for the lunar measurements was converted to an absolute filter radiometer with a 15 arc second field of view for martian radiance measurements. The modifications are described. Part 2 - The effects of solar wind protons on the lunar surface were simulated with a low-energy ion beam accelerator installed on a differentially-pumped, ultra high vacuum system. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-19892*# National Aeronautics and Space Administration, Washington, D.C.
ROCKET/NIMBUS SOUNDER COMPARISON (RNSC)
1972 46 p refs Conf. held at Wallops Island, Va., 23-24 Mar. 1971
(NASA-SP-296) Avail: NTIS CSCL 16D

The experimental results for radiance and temperature differences in the Wallops Island comparisons indicate that the differences between satellite and rocket systems are of the same order of magnitude as the differences among the various satellite and rocket sounders. The Arcasondes produced usable data to about 50 km, while the Datasondes require design modification. The SIRS and IRIS soundings provided usable data to 30 mb; extension of these soundings was also investigated. Author

N72-19893*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION Safety Analysis Report
30 Nov. 1971 100 p
(Contract NAS9-9953)
(NASA-CR-115461; SD-71-224; MSC-02478) Avail: NTIS CSCL 22B

The system safety analyses and requirements developed for the modular space station during the phase B extension are reviewed. Residual hazards and unresolved safety issues are summarized. Hazards resulting from equipment failures or malfunctions, operations, or credible accidents are identified and evaluated. Special safety trade studies are presented. Author

N72-19894*# General Dynamics/Convair, San Diego, Calif.
A STUDY TO DETERMINE THE FLIGHT CHARACTERISTICS AND HANDLING QUALITIES OF VARIABLE GEOMETRY SPACECRAFT. VOLUME 2: MEDIUM L/D CONCEPT WITH SWITCH-BLADE WINGS
B. J. Kuchta and G. R. Friedman Washington NASA Mar. 1972 69 p refs
(Contract NAS1-7971)
(NASA-CR-1789; GDC-DDE68-003-Vol-2) Avail: NTIS CSCL 22B

Flight characteristics and wing deployment transients for a variable geometry logistics spacecraft concept having a hypersonic lift-drag ratio near 2.0, and employing switch-blade wings for deployment at high subsonic speeds have been determined. These characteristics are based on detailed static wind tunnel results and estimated weight and inertial characteristics of a 9-man logistics lifting entry vehicle. In all instances, unpowered flight is assumed. The present volume is the second of a four volume series encompassing hypersonic lift-drag ratio vehicles from 1 to 3, and including several forms of deployable lifting surfaces. For Volumes 1 and 3, see N70-25699 and N72-15779 respectively. Author

N72-19895*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: EXPERIMENTAL INVESTIGATIONS FOR BASE DRAG REDUCTION ON A 0.015 SCALE MODEL MSFS PROPOSED SPACE SHUTTLE BOOSTER AT MACH NUMBERS FROM 0.40 TO 1.10
Dale Bradley Feb. 1972 60 p
(Contract NAS8-4016)
(NASA-CR-120030; DMS-DR-1212) Avail: NTIS CSCL 22B

A 0.015-scale model of a modified version of the MDAC space shuttle booster was tested to obtain force, static stability, and control effectiveness data. The objective of this test was the reduction of cruise (M = 0.4) base drag by the use of base flaps, base vents, elevon deflection and base flow from a plenum mounted forward of the base heat shield. Transonic data were also obtained to determine the aerodynamic characteristics of the new base shape. Six component aerodynamic force and moment data were recorded over an angle of attack range from 4 deg to 20 deg at 0 deg sideslip and over a sideslip range from -6 deg to 6 deg at 0 deg, 6 deg and 15 deg angle of attack. Mach number varied from 0.4 to 1.10 at a constant R of 2 million per unit length. Author

N72-19896*# Chrysler Corp., Huntsville, Ala.
SPACE SHUTTLE: VERIFICATION OF TRANSITION REENTRY CORRIDOR AT HIGH ANGLES OF ATTACK AND DETERMINATION OF TRANSITION AERODYNAMIC CHARACTERISTICS AND SUBSONIC AERODYNAMIC CHARACTERISTICS AT LOW ANGLES OF ATTACK FOR THE BOEING H-32 BOOSTER
J. Houser, L. J. Johnson, M. Oiye, and W. Runciman Feb. 1972 286 p
(Contract NAS8-4016)
(NASA-CR-120018; DMS-DR-1191) Avail: NTIS CSCL 22A

Experimental aerodynamic investigations were made in a transonic wind tunnel on a 1/150-scale model of the Boeing H-32 space shuttle booster configuration. The purpose of the test was: (1) to verify the transonic reentry corridor at high angles of attack; (2) to determine the transonic aerodynamic characteristics; and (3) to determine the subsonic aerodynamic characteristics at low angles of attack. Test variables included configuration buildup, horizontal stabilizer settings of 0 and -20 deg, elevator deflections of 0 and -30 deg, and wing spoiler settings of 60 deg. Author

N72-19897# Joint Publications Research Service, Arlington, Va.
CONDITIONS FOR FLIGHT OF MARTIAN SPACE PROBES
N. Aristov and I. Frolov 15 Mar. 1972 9 p refs Transl. into ENGLISH from Avait. Kosmonaut. (USSR), no. 2, Feb. 1972 p 32-33
(JPRS-55440) Avail: NTIS

The criteria for planning a Mars probe are presented. The parameters considered are: date of launching, vehicle propulsion velocity, flight duration, trajectory, accurate actual position of the spacecraft, and flight trajectory corrections. F.O.S.

N72-19898*# Chrysler Corp., Huntsville, Ala. Space Div.
SPACE SHUTTLE: STATIC AERODYNAMIC CHARACTERISTICS OF THE MSC-040A THE MSC-040A SPACE SHUTTLE ORBITER WITH WEDGE CENTERLINE VERTICAL AND TWIN VERTICAL TAILS AT MACH NUMBERS FROM 0.6 TO 4.96
K. J. Glass and A. M. Whitnah Mar. 1972 1355 p
(Contract NAS8-4016)
(NASA-CR-120050; DMS-DR-1243) Avail: NTIS CSCL 22B

The results are presented from experimental aerodynamic investigations conducted on a 0.6-percent scale model of the MSC-040 space shuttle orbiter in a 14 inch trisonic wind tunnel. The purpose of the test program was to define the stability, control, and performance characteristics of the baseline MSC-040A orbiter configuration with proposed alternate wing pods, with several vertical tail configurations with and without flared rudders, and with upper wing surface flap deflections. Force and moment data and model base and balance cavity pressure data were obtained for a Mach range of 0.60 through 4.96 and dynamic pressure range of 465 through 1580 psf. Model attitude was varied from 0 to +34 degrees angle of attack at zero sideslip and -4 to +10 degrees angle of sideslip at 0, 10, 20, and 24 degrees angle of attack. Author

N72-19899*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: HIGH ANGLE OF ATTACK TRANSITION AND LOW ANGLE OF ATTACK LAUNCH PHASE AERODYNAMIC STABILITY AND CONTROL OF GD/C B-18E-2, B-18E-3 DELTA WING BOOSTER, AND LAUNCH CONFIGURATION OF MSC-040A ORBITER AND TWIN PRESSURE FED BOOSTERS
John M. DeBevoise and Robert F. McGinnis Feb. 1972 401 p
(Contract NAS8-4016)
(NASA-CR-120028; DMS-DR-1210) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The test was a conventional stability and control test except for two aspects. One was the very high angles of attack at which the delta wing configurations were tested (up to 60 degrees) at Mach numbers of 3 and 4.96. The other was the installation of the orbiter and twin boosters in a manner that caused the support system to induce normal forces and side forces on the aft portion of the boosters at all Mach numbers; i.e., the support and the booster bodies were close together, side by side. Author

N72-19900*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC STABILITY AND CONTROL INVESTIGATION OF NR/GD DELTA WING BOOSTER (B-20) AND DELTA WING ORBITER (134D), VOLUME 1
E. C. Allen and F. W. Eder Feb. 1972 323 p
(Contract NAS8-4016)
(NASA-CR-119994; DMS-DR-1130-Vol-1) Avail: NTIS HC

$6.00/MF $0.95 CSCL 22B

Experimental aerodynamic investigations have been made on a .0035 scale model North American Rockwell/General Dynamics version of the space shuttle. Static stability and control data were obtained on the delta wing booster alone (B-20) and with the delta wing orbiter (134D) mounted in various positions on the booster. Six component aerodynamic force and moment data were recorded over an angle of attack range from -10 deg to 24 deg at 0 deg and 6 deg sideslip angles and from -10 deg to +10 deg sideslip at 0 deg angle of attack. Mach number ranged from 0.6 to 4.96. Author

N72-19901*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO EXPERIENCE REPORT: LUNAR MODULE DISPLAY AND CONTROL SUBSYSTEM

Andrew J. Farkas Washington Mar. 1972 35 p

(NASA-TN-D-6722; MSC-S-285) Avail: NTIS CSCL 22C

The lunar module display and control subsystem equipment is described with emphasis on major problems and their solutions. Included in the discussion of each item is a description of what the item does and how the item is constructed. The development, hardware history, and testing for each item are also presented. Author

N72-19902*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO EXPERIENCE REPORT: COMMAND AND SERVICE MODULE ENVIRONMENTAL CONTROL SYSTEM

Frank H. Samonski, Jr. and Elton M. Tucker Washington Mar. 1972 29 p

(NASA-TN-D-6718; MSC-S-279) Avail: NTIS CSCL 22C

A comprehensive review is presented of the design philosophy of the Apollo environmental control system together with the development history of the total system and of selected components within the system. In particular, discussions are presented relative to the development history and to the problems associated with the equipment cooling coldplates, the evaporator and its electronic control system, and the space radiator system used for rejection of the spacecraft thermal loads. Apollo flight experience and operational difficulties associated with the spacecraft water system and the waste management system are discussed in detail to provide definition of the problem and the corrective action taken when applicable. Author

N72-19903*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO EXPERIENCE REPORT: S-BAND SYSTEM SIGNAL DESIGN AND ANALYSIS

Harold R. Rosenberg, ed. Washington Mar. 1972 78 p refs

(NASA-TN-D-6723; MSC-S-288) Avail: NTIS CSCL 22C

A description is given of the Apollo communications-system engineering-analysis effort that ensured the adequacy, performance, and interface compatibility of the unified S-band system elements for a successful lunar-landing mission. The evolution and conceptual design of the unified S-band system are briefly reviewed from a historical viewpoint. A comprehensive discussion of the unified S-band elements includes the salient design features of the system and serves as a basis for a better understanding of the design decisions and analyses. The significant design decisions concerning the Apollo communications-system signal design are discussed providing an insight into the role of systems analysis in arriving at the current configuration of the Apollo communications system. Analyses are presented concerning performance estimation (mathematical-model development through real-time mission support) and system deficiencies, modifications, and improvements. Author

N72-19904*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO EXPERIENCE REPORT: ELECTRONIC SYSTEMS TEST PROGRAM ACCOMPLISHMENTS AND RESULTS

Thomas E. Ohnesorge Washington Mar. 1972 68 p

(NASA-TN-D-6720; MSC-S-283) Avail: NTIS CSCL 09C

A chronological record is presented of the Electronic Systems Test Program from its conception in May 1963 to December 1969. The original concept of the program, which was primarily a spacecraft/Manned Space Flight Network communications system compatibility and performance evaluation, is described. The evolution of these concepts to include various levels of test detail, as well as systems level design verification testing, is discussed. Actual implementation of these concepts is presented, and the facility to support the program is described. Test results are given, and significant contributions to the lunar landing mission are underlined. Plans for modifying the facility and the concepts, based on Apollo experience, are proposed. Author

N72-19905*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO EXPERIENCE REPORT: ACCEPTANCE CHECKOUT EQUIPMENT FOR THE APOLLO SPACECRAFT

I. J. Burtzlaff Washington Mar. 1972 15 p

(NASA-TN-D-6736; MSC-S-281) Avail: NTIS CSCL 22D

The acceptance checkout equipment for the Apollo spacecraft is described, and the history of the major equipment modifications that were required to meet the Apollo Program checkout requirements is traced. Some major problem areas are outlined, and a discussion of future checkout methods is included. The concept of the future checkout methods presented provides for an increase in test equipment standardization among NASA programs and among all testing phases within a program. The capability for increased automation and reduction in the test equipment inventory is provided in the proposed concept. Author

N72-19906*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO EXPERIENCE REPORT: STRUCTURAL LOADS DUE TO MANEUVERS OF THE COMMAND AND SERVICE MODULE/LUNAR MODULE

Michael J. Rutkowski Washington Mar. 1972 19 p refs

(NASA-TN-D-6719; MSC-S-280) Avail: NTIS CSCL 22B

Analyses were performed to determine the structural loads caused by maneuvers of the docked Apollo command and service module/lunar module (CSM/LM). Results of CSM/LM docked interface loads analyses and service-propulsion-system engine support structure load analyses are compared with the structural allowable loads of the CSM/LM docked interface and the service-propulsion-system engine thrust mount, respectively, for different phases of spaceflight operations. An analysis also was performed to investigate the loads that resulted from the failure case in which the LM descent propulsion system is started in the full-throttle position. Author

N72-19907*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

APOLLO EXPERIENCE REPORTS: WINDOW CONTAMINATION

L. J. Leger and R. W. Bricker Washington Mar. 1972 17 p refs

(NASA-TN-D-6721; MSC-S-284) Avail: NTIS CSCL 22C

The problem of window contamination in the Apollo command module is reviewed. All five command module windows were contaminated while in earth orbit on the first three manned Apollo flights. The contamination sources were identified and eliminated. Preflight testing of lunar module windows showed that no serious contamination should occur, and this conclusion was verified in subsequent manned flights. The command module window designs and materials are described, the window contamination sources are identified, and the inflight and chemical analyses of the contamination are outlined. The corrective actions that were taken are reviewed. For the lunar module, the window design and materials and the preflight and

fight evaluations are described. Window design recommendations are made. Author

N72-19908# Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany).
THE HELIOS PROGRAM: PROGRESS AND MANAGEMENT [HELIOS PROGRAMM: FORTSCHRITT UND MANAGEMENT]
Ants Kutzer Cologne DGLR 1971 48 p refs In GERMAN; ENGLISH summary Presented at the 4th DGLR Ann. Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The solar probe Helios will make two missions in 1974 and 1975 to within 0.25 - 0.3 astronomical units of the sun. Helios is the biggest and most advanced space project of the Federal Republic of Germany carried out as part of a cooperative program with NASA. A summary of program status and progress is made. Project management procedures used and experience gained are described. Author (ESRO)

N72-19909# Gesellschaft fuer Weltraumforschung m.b.H., Bad Godesberg (West Germany). Projektleitung Aeros.
THE GERMAN RESEARCH SATELLITE AEROS: MEASURING SEQUENCES OF SCIENTIFIC EXPERIMENTS CONTROLLED BY THE FLIGHT DIRECTION [DEUTSCHER FORSCHUNGSSATELLIT AEROS: VON DER FLUGRICHTUNG GESTEUERTE MESSPHASEN DER WISSENSCHAFTLICHEN EXPERIMENTE]
R. D. Guenther Cologne DGLR 1971 31 p refs In GERMAN; ENGLISH summary Presented at the 4th DGLR Ann. Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

The mass spectrometer, retarding potential analyzer, and neutral atmosphere temperature experiment are designed to measure and to provide scientific data during optimal spin phase. This requirement, while being compatible to the ground station, will be accomplished by an on-board telemetry system with a variable time base. Triggering is done by a sensor system approximately measuring the flight velocity vector, so that measurement and transmission of data can be put into optimal spin phases. Principles of the phase control of the experiments are presented. Author (ESRO)

N72-19910# Entwicklungsring Nord, Bremen (West Germany).
DESIGN OF A SPACE PROBE FOR PROVING EXPERIMENTALLY EINSTEIN'S GRAVITATION THEORY [ENTWURF EINER RAUMSONDE FUER DEN EXPERIMENTELLEN NACHWEIS DER EINSTEIN'SCHEN GRAVITATIONSTHEORIE]
G. Schneider Cologne DGLR 1971 18 p In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
Avail: NTIS

A system is proposed which would enable experiments to be carried out to prove Einstein's gravitational theory. By compensation of all disturbances, liable to perturb a pure gravitational orbit of the space probe, the Einstein parameters beta, gamma, and J2 could be determined with an accuracy never obtained before. The system design is simple, but very careful mass distribution, positioning, and measurement is necessary. An unambiguous applicability of a proposed laser telescope experiment cannot be proved. ESRO

N72-19911# Institut d'Aeronomie Spatiale de Belgique, Brussels.
TABLE OF ARTIFICIAL SATELLITES, 1957-1970 [TABLEAU DES SATELLITES ARTIFICIELS: 1957-1970]
J. Vercheval 1971 110 p In FRENCH; ENGLISH summary *Its* Aeronomica Acta No. F-20-1971
Avail: NTIS

Some data on satellite launch dates, delays, orbits, and weights are tabulated. The artificial satellites are listed in alphabetical order of satellite name; the American military satellites in launch date chronological order. In addition a list giving the principle active satellite emission frequencies is presented in launch date chronological order. ESRO

N72-19912# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE SPACE TUG: FEASIBILITY AND ADVANTAGES OF ATMOSPHERIC BRAKING WHEN RETURNING FROM LONG DISTANCE MISSIONS
Jean-Pierre Peltier and Daniel Balageas 1971 62 p refs In FRENCH; ENGLISH summary
(ONERA-NT-177) Avail: NTIS

The advantages of using atmospheric braking for space tug maneuvers during the transfer into low geostationary orbit are presented. Thermal radiative protection problems and their effects on the space tug configurations are investigated for a space tug returning from a geostationary orbit. The proper heat protection is a radiative shielding. It is concluded that for presently estimated tug masses (4000 to 8000 lb) atmospheric braking is the more economic system. ESRO

N72-19913# Army Foreign Science and Technology Center, Charlottesville, Va.
ANTIRADAR CAMOUFLAGE
Yurii Griorevich Stepanov 1971 14 p refs Transl. into ENGLISH from the book "Protivoradiolokatsion-Naya Maskirovka" Moscow, 1968 p 136-144
(AD-733507; FSTC-HT-23-442-70) Avail: NTIS CSCL 16/3

An analysis is presented of antiradar techniques which can be used over various portions of the trajectory of an ICBM. Techniques include emission of false targets, low reflective paint and coatings for warheads, and the usage of warhead shapes designed to reduce reflection. Author (GRA)

N72-19914# Advanced Technology Labs., Inc., Jericho, N.Y.
A CONCEPTUAL DESIGN STUDY FOR A LOW ALTITUDE HIGH MACH NUMBER VEHICLE Final Report, Nov. 1969 - Sep. 1970
Gerald Roffe, Marian Visich, Jr., and John Ranlet Sep. 1971 146 p refs
(Contract F33165-70-C-1191)
(AD-731561; ATL-TR-157; AFFDL-TR-71-48) Avail: NTIS CSCL 16/4

A design concept is presented for an unmanned vehicle capable of sea level flight at Mach 6 for a distance on the order of 100 miles. The concept utilizes aerodynamic interference to minimize wave drag and stratified compression and combustion to reduce structural and heating loads on the vehicle. The three dimensional geometry of the inlet and nozzle ducts is derived using a method of streamtube tracing which provides a predefined flow field for flight at the design Mach number. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-19915 National Lending Library for Science and Technology, Boston Spa (England).
FATIGUE BEHAVIOUR OF METALLIC MATERIALS IN A VACUUM AND VARIOUS GAS ENVIRONMENTS, PART 1
M. Bohmer et al 28 Dec. 1971 20 p Transl. into English from Metallwiss. Technik. (East Berlin), v. 24, 1970 p 446-455
(NLL-CE-Trans-5727-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Experimental results covering the fatigue behavior of metallic

materials in vacuum and gas environments are presented. They are: (1) The number of cycles to failure as a function of gas pressure usually shows a large change in a specific pressure band; this also applies to the crack propagation velocity. (2) The fatigue strength of materials with breakpoints in their SN curves is practically unaffected by the surrounding atmosphere. (3) Contradictory results are obtained for the temperature and frequency dependence of the cycles to failure/pressure curves. (4) Fatigue life is affected most by oxygen and water vapor. With many, if not all materials, a minimum amount of oxygen and water vapor must be present if there is to be any effect. Results also show that crack velocity is influenced by the surrounding medium mainly during the initial stage of crack propagation and that fracture surfaces show the mechanisms of crack propagation are different in air and in vacuum, the difference being one of kind rather than rate. No positive results were obtained regarding the effect of gases on slipband and crack formation. Author

N72-19916 National Lending Library for Science and Technology, Boston Spa (England).
LONG-TERM STRENGTH OF REINFORCED PLASTICS UNDER STATIC LOADING
B.-S. Berndtsson Nov. 1971 29 p refs Transl. into ENGLISH from Plastvarlden (Halgingborg), no. 4, 1971 p 40-43 and no. 6, 1971 p 43-47
(NLL-Lib-Comm-1646-(5196)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Principles concerning the long-term mechanical properties of plastics under static loading are presented. The dependence on time of various mechanical properties is discussed along with the failure mechanism. In reinforced plastics the time until failure is shown to be dependent on failure in the fiber material, failure in the plastic, or failure in the bond between plastic and fibers. The effects of water, temperature, and chemical action are also discussed. F.O.S.

N72-19917# Advisory Group for Aerospace Research and Development, Paris (France).
OPTIMALITY CRITERIA IN STRUCTURAL DESIGN
W. Prager (Brown Univ., Providence) Dec. 1971 17 p refs
(AGARD-R-589-71) Avail: NTIS

The derivation of optimality conditions from extremum principles of structural theory, with special emphasis on conditions for global optimality is studied. After a brief introduction, optimal design of sandwich structures is discussed for a single behavioral constraint or multiple constraints. Structural elements with solid sections are treated. A three-dimensional problem that includes many problems of optimal structural design as special cases is investigated. The optimality criteria are presented in a unified way that frequently suggests the form of optimality conditions in new situations. Author

N72-19918*# Structures Research Associates, Laguna Beach, Calif.
FEASIBILITY STUDY OF SHELL BUCKLING ANALYSIS USING THE MODIFIED STRUCTURE METHOD
Gerald A. Cohen and Raphael T. Haftka Washington NASA Mar. 1972 36 p refs
(Contract NAS1-10800)
(NASA-CR-2008) Avail: NTIS CSCL 20K

The modified structure method, which is based on Koiter's theory of imperfections, was used to calculate approximate buckling loads of several shells of revolution. The method does not appear to be practical for shells because, in many cases, the prebuckling nonlinearity may be too large to be treated accurately as a small imperfection. Author

N72-19919# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
FATIGUE STRENGTH OF MAGNESIUM ALLOY LUGS
A. A. Jongebreur 6 Dec. 1971 20 p refs
(SP-73) Avail: NTIS

Based on the results of fatigue tests according to test request AvB 804 and some literature data, a calculation method for the fatigue strength of magnesium alloy lugs was established, which is equivalent with the method used in TH.3.411 for aluminum alloy lugs. There is also some test evidence about the influence of sealants on the fatigue strength. Application of loctite gives, as already known, an improvement of the fatigue strength, in comparison with the VFW-614 process. Author

N72-19920# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
RELATION BETWEEN THE ULTIMATE SHEAR STRESS AND THE ULTIMATE TENSILE STRESS
A. W. Spaink 25 Mar. 1971 39 p refs
(SM-63) Avail: NTIS

A method for predicting the ultimate shear stress for materials as a function of the ultimate tensile strength is described. Illustrations are provided for steel, aluminum, magnesium and titanium alloys. The forms in which the materials are described are: (1) plate and sheet, (2) extrusions, (3) bar, rod, and wire, (4) forgings, and (5) castings. Data are presented in the form of graphs and tables for the materials and forms described. Author

N72-19921*# Lockheed-Georgia Co., Marietta.
STUDY OF EFFECTS OF DESIGN DETAILS ON STRUCTURAL RESPONSE TO ACOUSTIC EXCITATION
F. F. Rudder, Jr. Washington NASA Mar. 1972 61 p refs
(Contract NAS1-9526)
(NASA-CR-1959) Avail: NTIS CSCL 20K

The normal mode vibration characteristics of one-dimensional and two-dimensional panel arrays were investigated analytically and experimentally. The finite element displacement method was used to formulate the structural models. The structural models include a stiffness and consistent mass matrix for thin-walled open-section beams not previously reported, and a modification of a rectangular plate bending element to include a fundamental interior mode for the element as a generalized coordinate. Provision for adding lumped masses to represent accelerometers is also included. For the one-dimensional panel, the normal mode stress resultants are obtained by integrating the equilibrium equations directly. For the two-dimensional panel arrays, the solution for the stress resultants in the cover sheet was attempted by introducing stress functions dependent upon the displacement field of the plate element. This approach, although incomplete, is a natural extension of the one-dimensional analysis for plate elements. The exerimental program which was used to verify the analysis is described and experimental results are compared with the analysis. Author

N72-19922*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
EXPERIMENTAL INVESTIGATION OF MACH 3 CRUISE HEATING SIMULATIONS ON A REPRESENTATIVE WING STRUCTURE FOR FLIGHT LOADS MEASUREMENT
Roger A. Fields, Frank V. Olinger, and Richard C. Monaghan Washington Mar. 1972 42 p refs
(NASA-TN-D-6749; H-676) Avail: NTIS CSCL 20K

Radiant heating experiments were performed in the laboratory on an instrumented multispar wing structure to investigate: (1) how accurately the structural temperatures of a Mach 3 cruise-flight profile could be simulated, (2) what the effects of the heating and heating inaccuracies would be on the responses of strain-gage bridges installed on the structure, and (3) how these responses would affect flight loads measurements. Test temperatures throughout the structure agreed well with temperatures calculated for a Mach 3 profile. In addition, temperatures produced by two identical tests were repeatable to less than + or -6 K deg. Thermally induced strain-gage-bridge responses were large enough to be detrimental to a high-speed flight loads program with a goal of establishing aerodynamic loads (exclusive of thermal loads). It was shown that heating simulation can be used effectively for thermal calibration (that is,

to provide corrections for a high-temperature environment), and that thermal calibration may not be needed if the simulation data are used to carefully select bridges and load equations. Author

N72-19923# United Kingdom Atomic Energy Authority, Risley (England). Safety and Reliability Directorate.
EFFECT OF PRIOR AND PERIODIC OVERSTRESSING ON FATIGUE ENDURANCE
Sep. 1971 8 p refs
(SRD-R-2) Avail: AEC Depository Libraries

Relevant literature is reviewed and it is shown that, far from causing premature failure, the periodic overstressing of a component considerably increases its fatigue life. As a consequence of this, failure probabilities obtained from vessels subjected to repeated pressure tests are not relevant to vessels not subjected to repeated pressure tests. It is also shown that if periodic loads of reversed sign to the main opertional stress are applied to a component then the fatique life is considerably reduced. Such a system would result from a compressive thermal stress induced on the internal surface of a pressurised component subject to a positive temperature transient. Author

N72-19924# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
SHEAR BUCKLING OF ISOTROPIC AND ORTHOTROPIC PLATES: A REVIEW
D. J. Johns London Aeron. Res. Council 1971 36 p refs Supersedes ARC-31348 Prepared for Brit. Aircraft Corp.
(Contracts BAC/R41W/30/NEW/LWS; KF/50/03/CB. 23a.)
(ARC-R/M-3677; ARC-31348) Avail: NTIS; HMSO: £1.30; PHI: $5.30

A review presented of the shear buckling of isotropic and orthotropic plates with a detailed consideration of the latter. An extensive bibliography is given and the details of the analyses in these papers are also discussed briefly in order to illustrate the development of theoretical and analytical technique. The relevant theoretical information for shear buckling and for the determination of buckling under combined stress systems including shear is presented graphically in the form of data sheets. Author (ESRO)

N72-19925# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIMIT ANALYSIS OF STRIP WITH HOLES
Jozef Miastkowski and Wojciech Szczepinski 17 Sep. 1971 27 p refs Transl. into ENGLISH from Mech. Teoretyczna Stosowana (Poland), v. 7, no. 3, 1969 p 335-352
(AF Proj. 6010)
(AD-733813; FTD-HC-23-826-71) Avail: NTIS CSCL 20/11

Theoretical and experimental limit analysis of strips with holes is presented. Two aluminum alloys PA2 and PA9 were tested. It was found that the yield point load generally coincides with the theoretical upper bound for both aluminum alloys displaying good ductility. The influence of thickness on the limit of strip with holes is also investigated. Author (GRA)

N72-19926# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDROELASTICITY OF SHELLS
E. N. Mnev and A. K. Pertsev 24 Aug. 1971 497 p refs Transl. into ENGLISH of "Gidro Uprugost Obolochek" Leningrad, Izd. Sudostr., 1970 p 1-365
(AD-731646; FTD-MT-24-119-71) Avail: NTIS CSCL 13/13

In this book are considered questions connected with the calculation of the interaction of shells with liquid: free and induced vibrations of shell - liquid system diffraction processes, the resistance of the shells which are in contact with liquid, and shells under dynamic loading. The book was designed for engineers, scientific workers, and instructors and students studying the dynamic strength of marine ship structures. It can also be useful to specialists of other domains of technology, who are interested in the behavior of shell - liquid systems in dynamics. Author (GRA)

N72-19927# Mechanical Technology, Inc., Latham, N.Y.
INDUCTIVE SENSING TECHNIQUE ADVANCEMENT Final Report
George Moross Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Sep. 1971 45 p
(Contract DAAJ02-70-C-0028)
(AD-734342; MTI-71TR41; USAAMRDL-TR-71-51) Avail: NTIS CSCL 14/2

The program is concerned with the advancement and development of the inductive sensing system. The system significantly enhanced in its ability to detect early fatigue damage in 6061 T-6 aluminum. Samples were fatigue cycled up to 2,000,000 cyles, and crack signals have been observed as early as 9.7% of life. The system greatly enhanced in its sensitivity to cracks and its insensitivity to extraneous factors such as probe proximity and generalized surface damage. This increased sensitivity to flaws, coupled with the ability to selectively disregard extraneous surface conditions or probe proximity, significantly advanced the state of the art in nondestructive testing. Author (GRA)

N72-19928# Stanford Univ., Calif. Dept. of Applied Mechanics.
DYNAMIC BEHAVIOR AND STABILITY OF SOLIDS AND STRUCTURES Interim Scientific Report, 1 Apr. 1970 - 31 Mar. 1971
George Herrmann Mar. 1971 10 p
(Grant AF-AFOSR-1905-70)
(AD-734288; AFOSR-71-1963TR) Avail: NTIS CSCL 20/11

The following phases of work were in progress on 31 March 1971: Moving loads acting on structural systems; Dynamics of composite materials; Dynamics and stability of rotating structures; Applications of microstructure mechanics; and, Dynamic interaction of structures and fluids. GRA

N72-19929# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMIZATION PROBLEMS IN SYNTHESIS OF MECHANICAL SYSTEM
Robert Staniszewski 26 Oct. 1971 27 p Transl. into ENGLISH from Mech. Teor. Stosowana (Poland), v. 8, no. 4, 1970 p 407-425
(AD-734350; FTD-HC-23-955-71) Avail: NTIS CSCL 20/11

The theories of construction of generalized characteristics are described in the paper, and their use as optimizing criteria is demonstrated. The object of investigations is assumed to be a mechanical system in a general sense, with respect to geometric, structural and loading properties and physical phenomena occuring in the systems. The relations concerning the technological effect and effort functions are derived. The general effect is defined as the ratio of the technological effect to the effort function. The reciprocal of the general effect is the so-called effort effect. The fundamental optimization equations are derived and general conclusions concerning the forms and generalized characteristics are drawn. Author (GRA)

N72-19930# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RATE OF PROPAGATION OF LARGE PLASTIC DEFORMATIONS
M. A. Baranovskii and N. I. Strikel 22 Oct. 1971 8 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Tekh. Navuk. (Minsk), no. 2, 1970 p 43-45
(AF Proj. 7343)
(AD-734351; FTD-HT-23-1214-71) Avail: NTIS CSCL 13/8

The questions associated with the rate of propagation of large plastic deformations in metals subjected to severe loading (e.g., in high speed rolling or forging) are discussed theoretically. A formula is proposed for the velocity of propagation of plastic deformations for the case in which no functional relationship exists between the mass velocity and the degree of deformation. The formula is suitable for all practical purposes involving large deformations. GRA

N72-19931# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
BUCKLING OF ELECTROFORMED CONICAL SHELLS UNDER HYDROSTATIC PRESSURE
Josef Singer and Bendavid Dror Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Sep. 1971 53 p refs
(Contract DAAJ02-67-C-0031)
(AD-734344; USAAVLABS-TR-69-65) Avail: NTIS CSCL 20/11

The report describes a series of tests made on the buckling of high quality, electroformed conical shells under hydrostatic pressure. The thirteen shells used were all of high taper ratio, ten having a taper ratio of 0.75 and 3 are of 0.669. The range of average radius to wall thickness covered was from 600-1200. The method of testing is discussed in detail, and the results obtained are compared with the linear theories of Seide and Singer. Author (GRA)

N72-19932# Naval Air Development Center, Johnsville, Pa.
EFFECTS OF SPECTRUM BLOCK SIZE AND STRESS LEVEL ON FATIGUE CHARACTERISTICS OF ALUMINUM ALLOY BOX BEAMS UNDER RANDOM SEQUENCE UNIDIRECTIONAL LOADING Final Report
William Breyan and Erwin P. Roeser 8 Dec. 1971 63 p refs
(AD-734393; NADC-ST-7013) Avail: NTIS CSCL 01/3

The results of random-sequence fatigue tests of 7075-T6 aluminum-alloy box beams in unidirectional bending are presented. The relative damaging effect of four airplane flight-maneuver-loads spectra was determined, and the effects on life for variation in spectrum block size and stress level were established. The effects of load sequence on life were determined through comparison and analysis of these data with that for fixed-sequence loading of a previous investigation. Author (GRA)

N72-19933# Army Foreign Science and Technology Center, Charlottesville, Va.
EFFECTIVE SOLUTION OF CERTAIN BOUNDARY VALUE PROBLEMS FOR PRISMATIC VARIABLE THICKNESS SHELLS
Y. E. Obolashvili Oct. 1971 12 p refs Transl. into ENGLISH from Tr. Mat. Inst., Akad. Nauk Gruz. SSR. (Tiflis), v. 33, 1967 p 88-92
(FSTC Proj. T7023012301)
(AD-734993; FSTC-HT-23-435-71) Avail: NTIS CSCL 20/11

Equilibrium equations for shells, in contrast to classical equations, are fully compatible with physical boundary conditions. This paper considers the ease where the pattern of the stress and deformation condition of the shell is subject to very insignificant change along the normal of the mean height. This case, called by I. N. Vekua an approximation of the order N=0, and representing a momentless theory, is supplemented in such a manner that the corresponding system of shell equations is common with three physical boundary conditions. Author (GRA)

N72-19934# Watervliet Arsenal, N.Y.
FREE VIBRATIONS OF UNIDIRECTIONAL FIBER REINFORCED COMPOSITE PLATES
Robert L. Ryan Jun. 1971 30 p refs
(DA Proj. 1F0-61102-A-350)
(AD-734822; WVT-7136) Avail: NTIS CSCL 11/4

A dynamical theory of plates based on the effective stiffness theory of fiber reinforced composites is developed. Both extensional and flexural vibrations are considered, and the dispersion relations appropriate to each are obtained. It was found that for flexural vibrations, an additional branch of the frequency spectrum arises. Author (GRA)

N72-19935# Illinois Inst. of Tech., Chicago. Dept. of Mechanics.
A SIMPLE FINITE ELEMENT MODEL FOR ELASTIC-PLASTIC PLATE BENDING
Arla McMahon and Philip G. Hodge, Jr. 1972 66 p refs
(Contract N00014-67-A-0210-0002; NR Proj. 064-429)
(AD-734689; DOMIIT-1-46) Avail: NTIS CSCL 20/11

A consistent finite element model for a plate is developed based on triangular elements and a piecewise-linear displacement field. The resulting generalized stresses are the average normal moments across the element interfaces. Equilibrium equations are derived for each node, and a simple constitutive equation is obtained for each generalized stress. Applications are made to some square plate problems. Author (GRA)

N72-19936# Illinois Inst. of Tech., Chicago. Dept. of Mechanics.
INVESTIGATIONS OF PLASTIC STRUCTURES AT ILLINOIS INSTITUTE OF TECHNOLOGY Final Report, 1 Nov. 1957 - 31 Oct. 1971
Philip G. Hodge, Jr. 1971 33 p refs
(Contract N00014-67-A-0210-0002; NR Proj. 064-429)
(AD-734690; DOMIIT-1-47) Avail: NTIS CSCL 13/13

The purpose of the two contracts was investigations into the plastic response of structures under arbitrary loading. These investigations were pursued in three general directions: basic theory, methods of solution, and applications. Results obtained have been fully presented in the reports listed in Appendix D; the remainder of the report is devoted to a brief review of the results obtained in these three categories. Author (GRA)

N72-19937# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
EFFECT OF FIBER DIRECTION ON THE INSTABILITY OF SINGLE LAYER GLASS CLOTH RESIN-IMPREGNATED CYLINDERS UNDER UNIFORM AXIAL COMPRESSION
Joseph John Minecci Sep. 1971 63 p refs
(Contract DA-44-177-AMC-115(T); DA Proj. 1F1-62204-A-170)
(AD-734889; USAAVLABS-TR-69-30) Avail: NTIS CSCL 20/11

The report presents the results of a series of experiments made on the effect of fiber direction on the compressive strength, stability, and stiffness of single-layer glass-cloth resin impregnated cylinders. It shows that while such direction is of extreme importance to the issues of strength and stiffness it does not significantly influence the critical load magnitudes. It demonstrates further that under repeated loading increasing damage is experienced by the fibers as their direction becomes more skew to the fold lines. Author (GRA)

N72-19938# Army Foreign Science and Technology Center, Charlottesville, Va.
THE APPLICATION OF LIKELIHOOD CRITERIA TO MATERIAL TESTING
V. N. Churakov 29 Oct. 1971 22 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 5, 1969 p 61-70
(AD-735017; FSTC-HT-23-606-71) Avail: NTIS CSCL 20/12

Equations are given for the deformation theory of plasticity with respect to material testing techniques. Author (GRA)

N72-19939# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF THE STABILITY OF A CYLINDRICAL SHELL LOADED BY EXTERNAL PRESSURE AND AXIAL COMPRESSIVE FORCES
L. V. Andreyev and I. F. Larionov 29 Oct. 1971 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn Zavedenii, Mashinstr. (Moscow), no. 8, 1969 p 43-47
(AF Proj. 6010)
(AD-734640; FTD-HT-23-1133-71) Avail: NTIS CSCL 20/11

The results of investigating the influence of axial compressive forces on the stability of a cylindrical shell loaded by external pressure are given. It is shown that up to a certain external pressure level the influence of axial compressive forces can be considered by a certain coefficient, given here as a graph. Tests were conducted with two series of shells on the simultaneous

action of external pressure and axial compression, on which the authors propose estimating the region of stability for this type of combined loading. Author (GRA)

N72-19940# Army Foreign Science and Technology Center, Charlottesville, Va.
THREE DIMENSIONAL DYNAMIC PROBLEM IN ELASTICITY THEORY FOR A MULTIPLY CONNECTED REGION
N. A. Shulga Oct. 1971 10 p refs Transl. into ENGLISH from Prikl. Mekh. (Ukrainia SSR), v. 5, 1969 p 115-119
(AD-734631; FSTC-HT-23-374-71) Avail: NTIS CSCL 20/11
Equations are given concerning space dynamics on the theory of elasticity for a multi-connected region. Author (GRA)

N72-19941# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
SHORT CUTS IN CREEP BUCKLING ANALYSIS
Nicholas J. Hoff and Ilan M. Levi Jun. 1971 29 p refs
(Contract F44620-69-C-0009; AF Proj. 9782)
(AD-734792; SUDAAR-425; AFOSR-71-1858TR) Avail: NTIS CSCL 20/11
It is shown that the creep buckling of slender or thin-walled structures whose material deforms elastically as well as in consequence of time-hardening creep can be analyzed first as if the deformations were due entirely to steady creep. The results of this analysis can be easily modified to account for time-hardening creep, and this modification does not involve any approximation when the time-hardening creep strain rate is expressed as the product of a function of stress by a function of time. Author (GRA)

N72-19942# Auburn Univ., Ala. Engineering Experiment Station.
CRACK TOLERATING ABILITY OF A HIGH STRENGTH BIAXIALLY STRESSED CYLINDRICAL PRESSURE VESSEL CONTAINING A SURFACE CRACK Final Report, 29 Jun. 1970 - 31 Dec. 1971
Hal W. Maynor and Richard S. Waldrop 31 Dec. 1971 30 p refs
(Contract DAAH01-70-C-1424)
(AD-734926; Rept-9) Avail: NTIS CSCL 13/4
Test specimens in the form of cylindrical pressure vessels were deep drawn from AISI 4130 steel and heat treated to an average uniaxial yield strength (0.2 per cent offset) of 207 ksi. Each vessel was provided with an initial surface crack consisting of a mechanically-produced slot, terminating at each end in a fatigue-induced, hairline-type crack. Strain gages mounted at both ends of the crack provided a measure of the displacement at these locations during the development of internal pressures culminating in bursting. Author (GRA)

N72-19943# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMOSTABILITY OF PLATES AND SHELLS
P. M. Ogibalov and V. F. Gribanov 2 Nov. 1971 152 p refs Transl. into ENGLISH of "Termoustoichivost Plastin Obolochek" Moscow, 1968 p 1-11, 410-518
(FTD Proj. 60106)
(AD-734918; FTD-HC-23-724-71) Avail: NTIS CSCL 13/13
The monograph is a study of the thermostability of plates and shells which are of great interest for modern engineering. Correct formulations of mechanical problems of thermostability and the methods for their solution are given in it, as well as specific examples of calculating the stability of plates and shells in linear and nonlinear (physically) arrangements having an applied interest. Here thermal shock and the repeated effects of temperature are also investigated, as well as the theory of a thermal boundary layer. Author (GRA)

N72-19944# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.
EXISTENCE OF A SOLUTION TO A MATERIAL OPTIMIZATION PROBLEM IN LINEAR VISCOELASTICITY
Jan B. Schipmolder Jun. 1971 45 p refs
(Grant AF-AFOSR-2062-71)
(AD-734787; AFOSR-71-1966TR; TR-3) Avail: NTIS CSCL 20/11
A solution is shown to exist to the problem of determining a linear viscoelastic material which optimizes a defined dynamical behavior of a specific structure. The structure is considered in this paper to be modeled by a single lumped mass and a single viscoelastic element in uniaxial tension, and its motion is to satisfy a number of given constraints and conditions at different strain rates. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-19945*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CRYOGENIC RESEARCH AT MSFC: RESEARCH ACHIEVEMENTS REVIEW, VOLUME 4 NO. 2
Nov. 1971 175 p refs
(NASA-TM-X-64561) Avail: NTIS CSCL 20M
Achievements in cryogenic research applicable to new programs such as the Skylab, space station, and space shuttle are described. For individual titles, see N72-19946 through N72-19955.

N72-19946*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTILAYER INSULATION THERMAL PROTECTION SYSTEMS TECHNOLOGY
E. H. Hyde *In its* Cryog. Res. at MSFC: Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 5-52 refs (See N72-19945 10-33)
Avail: NTIS CSCL 20M
A summary is presented of the work performed by Marshall Space Flight Center (MSFC) and industry toward the development of flight-type multilayer insulation(MLI) systems. The MSFC MLI program is divided into three large categories: (1) the generation and compilation of MLI composite test data; (2) the analysis, design, and testing of heat flow-through MLI applied to ducting, seams, electrical feedthroughs, structural supports, and the tank sidewall; and (3) the development, modification, and utilization of new testing procedures, tanks, and the test facilities. Numerous data have been generated, analyzed, and documented on different MLI composites. Author

N72-19947*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN FOR ADVANCED INSULATION SYSTEMS
J. M. Walters *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 53-72 refs (See N72-19945 10-33)
Avail: NTIS CSCL 20M
The design of principal multilayer insulation (MLI) systems being investigated by Marshall Space Flight Center and its contractors for application to flight-type cryogenic tankage for long-term storage in space vehicles is described. The MLI systems were designed for application to a 105 in. diameter cryogenic test tank to simulate full-scale design and installation methods representative of flight-type hardware. The MLI systems selected for design represent systems suitable for use on space vehicles such as the modular nuclear vehicles that require application of thicknesses up to 6 in. The MLI systems are lightweight and structurally efficient. Author

N72-19948*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MANUFACTURING DEVELOPMENTS IN INSULATION APPLICATION
Iva C. Yates, Jr. *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 73-92 refs (See N72-19945 10-33)
Avail: NTIS CSCL 20M

Manufacturing development studies have been conducted to provide information on the fabrication and handling characteristics of a number of candidate multilayer insulation systems. The application of these complex, lightweight insulation systems to large-scale, flight-type cryogenic tankage and other structures has of necessity required the development of new methods, processes, and tooling concepts. Results of some of the studies that have contributed to the advancement of cryogenic technology are presented. The insulation systems that are of primary importance for future application are those using the sliced foam spacers, the net type spacers, the glass fiber paper spacers, and the Superfloc system which consists of tufts of dacron fibers flocked on the surface of the radiation shields. Author

N72-19949*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTILAYER HIGH PERFORMANCE INSULATION MATERIALS
J. M. Stuckey *In its* Cryog. Res. At MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 93-98 (See N72-19945 10-33)
Avail: NTIS CSCL 20M

A number of tests are required to evaluate both multilayer high performance insulation samples and the materials that comprise them. Some of the techniques and tests being employed for these evaluations and some of the results obtained from thermal conductivity tests, outgassing studies, effect of pressure on layer density tests, hypervelocity impact tests, and a multilayer high performance insulation ambient storage program at the Kennedy Space Center are presented. Author

N72-19950*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SUPERCONDUCTING MAGNETS AND DEVICES FOR SPACE VEHICLES AND EXPERIMENTS c26
Eugene W. Urban *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 99-106 (See N72-19945 10-33)
Avail: NTIS CSCL 20C

Superconductivity research has been oriented toward those problems that tend to restrict the greater application of superconducting devices in space research and technology. These include magnetic problems of high field magnets, increasing operating temperatures, and development of useful competitive superconducting instruments. Author

N72-19951*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CRYOGEN ACQUISITION IN ORBIT c23
L. J. Hastings *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 107-134 refs (See N72-19945 10-33)
Avail: NTIS CSCL 20L

Orbital cryogen acquisition is a definite requirement for engine restart and/or propellant transfer on all major future missions. The most promising methods, especially for large scale vehicles, are acquisition by linear acceleration and acquisition by capillary systems. Intermittent acceleration and propellant settling requires some state-of-the-art extension since it has not been attempted on a large scale cryogen vehicle. Capillary acquisition systems offer the advantages of reusability, passiveness, low weight, and mission flexibility. The major disadvantage is that of an undeveloped technology. The method does not lend itself to verification through ground testing. Author

N72-19952*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LONG TERM CRYOGENIC STORAGE SYSTEM INTEGRATION c23
R. E. Stonemetz, J. H. Pratt, and T. W. Winstead *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 135-152 refs (See N72-19945 10-33)
Avail: NTIS CSCL 20L

Investigations have revealed significant increases in performance when a reliquefier and solar shield in conjunction with a zero-gravity vapor vent system are utilized. Application of a reliquefier and solar shield in long term deep space missions may effect a 60% reduction in propellant loss, compared to that associated with the vapor vent system only. Significant improvements in storage system performance are possible for low earth orbit applicatons; for the typical system that was evaluated, system performance gains were realized for mission durations exceeding 7 days. Spherical solar shields are generally not competitive for low earth orbit applications. Author

N72-19953*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADVANTAGEOUS USE OF SLUSH AND GELLED SLUSH IN SPACE VEHICLES c27
J. Z. Adamson *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 153-168 refs (See N72-19945 10-33)
Avail: NTIS CSCL 21I

The advantages of combining both slush and gel have been recognized. These advantages are: (1) a reduction in the gelling agent necessary; (2) the achievement of active positioning; and (3) a potential increase in impulse density. The need for extended mission capability as indicated by present mission planning is outlined and the expected schedules are presented. A condensed version of analytical and testing conclusions as related to storage systems and slush is given. The significant results of slush flow testing and its possible influence on vehicle propulsion systems are presented, and the characterization and preparation of gels are discussed in relation to future applications, advantages, and disadvantages. Author

N72-19954*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROPELLANT THERMAL STRATIFICATION c27
T. W. Winstead *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 169-178 refs (See N72-19945 10-33)
Avail: NTIS CSCL 21I

The term thermal stratification is used to express nonuniform heat distribution within the bulk propellant. The nonuniform distribution of heat results in significant temperature variations in booster propulsion propellants and causes an undesirable increase in the self-pressurization rate of cryogen storage systems. A semiempirical prediction method has been developed for high gravity environments and is adequate for design purposes; model accuracy is somewhat limited to similarity in tank geometries, and additional work is needed to extend the correlation range. Several low gravity environment models that cover a broad range of predicted results have been developed. There are no applicable data by which any of these models may be selected in preference over the others. Author

N72-19955*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIALS FOR FOAM TYPE INSULATION
W. E. Hill *In its* Cryog. Res. at MSFC: Res. Achievements Rev., Vol. 4, No. 2 Nov. 1971 p 179-184 (See N72-19945 10-33)
Avail: NTIS CSCL 20M

An internal foam fabrication is one of the concepts being considered for cryogenic insulation on the hydrogen tanks of the shuttle vehicle. The three-dimensional polyurethane used on the S-4 B tanks failed to meet the higher temperature requirements of the shuttle vehicle, however, and other foams under

consideration include polyisocyanurates, polyphenylene oxides, polyimides, and polybenzimidazoles. Improved adhesive systems for attaching the foams to the interior tank wall are under study.
Author

N72-19956*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
PHASE CHANGE MATERIALS HANDBOOK
D. V. Hale, M. J. Hoover, and M. J. ONeill Sep. 1971 200 p refs
(Contract NAS8-25183)
(NASA-CR-61363; LMSC-HREC-D225138) Avail: NTIS CSCL 20M

This handbook is intended to provide theory and data needed by the thermal design engineer to bridge the gap between research achievements and actual flight systems, within the limits of the current state of the art of phase change materials (PCM) technology. The relationship between PCM and more conventional thermal control techniques is described and numerous space and terrestrial applications of PCM are discussed. Material properties of the most promising PCMs are provided; the purposes and use of metallic filler materials in PCM composites are presented; and material compatibility considerations relevant to PCM design are included. The engineering considerations of PCM design are described, especially those pertaining to the thermodynamic and heat transfer phenomena peculiar to PCM design. Methods of obtaining data not currently available are presented. The special problems encountered in the space environment are described. Computational tools useful to the designer are discussed. In summary, each aspect of the PCM problem important to the design engineer is covered to the extent allowed by the scope of this effort and the state of the art.
Author

N72-19957*# Michigan Univ., Ann Arbor. Infrared and Optics Lab.
MEASUREMENT OF TEMPERATURE PROFILES IN FLAMES BY EMISSION-ABSORPTION SPECTROSCOPY Final Report
F. S. Simmons, C. B. Arnold, and G. H. Lindquist Feb. 1972 101 p refs
(Contract NAS3-13037)
(NASA-CR-120894; WRL-30410-19-F) Avail: NTIS CSCL 20M

An investigation was conducted to explore the use of infrared and ultraviolet emission-absorption spectroscopy for determination of temperature profiles in flames. Spectral radiances and absorptances were measured in the 2.7-micron H2O band and the 3064-A OH band in H2/O2 flames for several temperature profiles which were directly measured by a sodium line-reversal technique. The temperature profiles, determined by inversion of the infrared and ultraviolet spectra, showed an average disagreement with line-reversal measurements of 50 K for the infrared and 200 K for the ultraviolet at a temperature of 2600 K. The reasons for these discrepancies are discussed in some detail.
Author

N72-19958# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
REPORT ON THE DGLR-SYMPOSIUM ON THERMALTECHNOLOGY
Dec. 1971 71 p refs Conf. held at Porz-Wahn, West Ger., 22 Jun. 1971
(DLR-Mitt-71-23) Avail: NTIS

The proceedings of a conference on thermal control of spacecraft environments and systems are presented. The principles for temperature control for all phases of a space mission are discussed. The contribution made by the thermodynamic properties of materials used in spacecraft structures are analyzed. Types of protective coatings are tabulated to show the chemical composition and the areas of application within the spacecraft.
P.N.F.

N72-19959*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT-AND GROUND-TEST EVALUATION OF PYRRONE FOAMS
Allen G. McLain and Warren C. Kelliher Washington Mar. 1972 34 p refs
(NASA-TN-D-6711; L-8100) Avail: NTIS CSCL 11D

Two Pyrrone materials, pure Pyrrone foam with a density of 481 kg/cu m and hollow glass microsphere-Pyrrone composite with a density of 962 kg/cu m, were tested in the Langley 20-inch hypersonic arc heated tunnel at pressure levels from 0.06 to 0.27 atm and heating rates from 1.14 to 11.4 MW/sq m. The 481-kg/cu m Pyrrone foam was also flight tested as an experiment aboard a Pacemaker test vehicle. The results of the ground tests indicated that the thermal effectiveness of the 481-kg/cu m Pyrrone foam was superior to the 962-kg/cu m glass sphere-Pyrrone composite. The 481-kg/cu m Pyrrone foam had approximately one-half the thermal effectiveness of low density phenolic nylon. The 481-kg/cu m Pyrrone foam experienced random mechanical char removal over the entire range of test conditions. Char thermal property inputs for an ablation computer program were developed from the ground test data of the 481-kg/cu m Pyrrone foam. The computer program using these developed char thermal properties, as well as the measured uncharred material properties, adequately predicted the in-depth temperature histories measured during the Pacemaker flight.
Author

N72-19960*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LAMINAR FLOW STUDIES OF A LOW-TEMPERATURE SPACE RADIATOR MODEL USING D-SHAPED TUBES
Theodore C. Cintula, George M. Prok, and Daniel B. Johnston Washington Mar. 1972 33 p refs
(NASA-TN-D-6727; E-6486) Avail: NTIS CSCL 20M

Test results of a low-temperature space radiator model are presented. Radiator performance is evaluated with a low-thermal-conductivity fluid in laminar flow in D-shaped cross-section tubes. The test covered a Reynolds number range from 50 to 4500 and a fluid temperature range from 294 to 414 K (70 to 286 F). For low-temperature radiators, the fluid-to-surface temperature differential was predominately influenced by fluid temperature in laminar flow. Heat transfer and pressure drop for the radiator tube could be predicted within engineering accuracy from existing correlations.
Author

N72-19961*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ACCELERATION LEVELS ON THE HEAT FLOW AND CONVECTION DEMONSTRATION, APOLLO 14
Eva Gatewood, Marvin G. Morris, and Robert L. Holland 11 Feb. 1972 17 p refs
(NASA-TM-X-64644) Avail: NTIS CSCL 20M

The method and data for determining the accelerations on the heat flow and convection demonstration are presented. From the analysis, it is concluded that accelerations as low as 0.02 micro g can be detected by using the attitude look angles to the earth and sun, the Apollo trajectory ephemeris, and the ephemeris of the sun.
Author

N72-19962# Rome Univ. (Italy). Inst. of Physics.
RECENT DEVELOPMENTS ON THE EQUILIBRIUM THERMODYNAMICS OF CRITICAL POINTS
D. Capocaccia and M. Vicentini-Missoni 20 Jul. 1971 39 p refs
(Nota-Interna-329) Avail: NTIS

Some ideas and experimental data on equilibrium properties of a thermodynamic system near a critical point are reviewed. Some results are derived for a one component system extended to multicomponent ones, and on the construction of correction terms to scaling, that can account for the behavior of nonsymmetric systems.
Author (ESRO)

N72-19963# Illinois Univ., Urbana.
INVESTIGATION OF TRANSIENT PHENOMENA IN DETONATIONS Contractor's Report, Jan. 1970 - Feb. 1971
Randall Jay Stiles Aberdeen Proving Ground, Md. BRL Sep. 1971 78 p refs
(Contract DAAD05-70-C-0219; RDT/E Proj. 1T0-61102-A-32-B)
(AD-733891; BRL-CR-52) Avail: NTIS CSCL 19/4

Studies of three transient situations in gaseous detonations were made. The transient phenomena were obtained by propagating a detonation across a contact surface artificially introduced into the shock tube. Transverse wave trajectories were obtained by smoked foil technique as functions of the gas compositions on either side of the contact surface. The mechanism of disappearance of transverse waves was found to be the same in all cases. Theory and experiment showed that the strength of a transverse wave was independent of the degree of asymmetry of the intersection. The asymmetric intersection is not necessary to cause decay of the wave system. Author (GRA)

N72-19964# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
IGNITION OF AIRCRAFT FLUIDS BY HOT SURFACES UNDER DYNAMIC CONDITIONS Technical Report, 1 Jan. 1969 - 31 Aug. 1971
Alexander Strasser Nov. 1971 41 p refs
(Contract F33615-69-M-5002; AF Proj. 3048)
(AD-734238; PMSRC-4162; AFAPL-TR-71-86) Avail: NTIS CSCL 21/2

Data are presented on the ignition characteristics of various aircraft fluids under conditions in which they impinge upon a hot surface in the presence of air flow similar to that possible in an aircraft enclosure. The fluids included two jet fuels (JP-4 and JP-8), two hydraulic fluids (MIL-H-5606 and MIL-H-83282), and an engine oil (MIL-L-7808). Generally, the ignition temperatures decreased with an increase in target diameter or surface area and increased with increasing air velocity. At all test conditions, the ignition temperatures of the fluids were noticeably higher than their minimum autoignition temperatures which are determined in uniformly heated vessels. GRA

N72-19965# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS AND CALCULATION OF SEPARATION IN TURBINE STAGES
G. A. Filippov 26 Oct. 1971 19 p refs Transl. into ENGLISH from Prace Inst. Maszyn Przeplywowych. Polska Akad. Nauk (Warsaw), no. 42-44, 1970 p 539-551
(FTD Proj. 6040102)
(AD-734221; FTD-HC-23-1088-71) Avail: NTIS CSCL 10/1

The motion of liquid phase and its separation in flow passages of steam turbines are controlled by complex phenomena, rendering the construction of a closed set of equations to represent the process difficult. The forces acting on fluid film and on drops are discussed in this paper, including forces of mutual interaction of the film, drops and steam, centrifugal forces, surface tension forces, and coriolis forces. Experimental data have been used to construct a formula for approximate determination of the separation coefficient. GRA

N72-19966# RAND Corp., Santa Monica, Calif.
EFFECTS OF STRONG EXPLOSIONS, 2 (SOVIET LITERATURE TRANSLATIONS)
Simon Kassel Sep. 1971 119 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-734202; R-760/1-ARPA) Avail: NTIS CSCL 19/4

The report is one of a series intended to provide a preliminary overview of current Soviet research activities on the effects of explosions. Interaction of explosions with the ground, the atmosphere, and materials have broad research ramifications and significance, especially in the case of nuclear explosions. The pertinent topics include simulation studies, effects of high pressures and temperatures on materials, reentry problems, radiation effects, electromagnetic phenomena, etc. Author (GRA)

N72-19967# Picatinny Arsenal, Dover, N.J.
THE GRUNEISEN CONSTANT OF POROUS MATERIALS IN ENERGY DEPOSITION MATERIALS
Paul Harris Aug. 1971 29 p refs
(AD-730906; PA-TR-4255) Avail: NTIS CSCL 19/4

It is proposed that the usual energy deposition (electron beam) experiments, as well as the usual shock introduction (flyer plate experiments do not yield a true Gruneisen parameter of porous materials. It is proposed that in a porous material stress relief occurs within the time that energy is being deposited, or before the final state is reached in a flyer plate experiment. Both types of experiments were analyzed and correlated and agreed with the ideas put forward here. Energy deposition experiments of Shea, Mazella, and Avrami (porous PETN), and flyer plate experiments of Boade (sintered porous copper), were considered. Wave propagation in porous materials was considered in some detail, and it was concluded that in such materials macroscopic measurements can not always be used to determine microscopic parameters. It is proposed that a porous material acts as a diffraction grating with respect to a shock wave, and that unidirectional one-dimensional strain does not hold. Author (GRA)

N72-19968# Southwest Research Inst., San Antonio, Tex.
GASEOUS EMISSIONS FROM A LIMITED SAMPLE OF MILITARY AND COMMERCIAL AIRCRAFT TURBINE ENGINES Interim Report
Charles T. Hare, Harry E. Dietzmann, and Karl J. Springer 31 Aug. 1971 131 p refs
(Contract EPA-EHSH-70-108)
(PB-204177; SwRI-AR-816) Avail: NTIS CSCL 21B

The objective of the aircraft turbine emissions measurement was to provide baseline gaseous emission data, including hydrocarbons, carbon monoxide, carbon dioxide, and oxides of nitrogen, in a very limited time frame. Seventy-one tests were conducted in all, first on two types of military engines and later on six types of commercial engines. GRA

N72-19969# Teledyne Continental Motors, Muskegon, Mich.
COLLECTION AND ASSESSMENT OF AIRCRAFT EMISSIONS Final Report
Jose F. Reguerio 22 Oct. 1971 121 p refs
(Contract EPA-68-04-0035)
(PB-204196; TCM-635) Avail: NTIS CSCL 21B

Five engines, each of four different models of aircraft piston engines, were tested for gaseous emission (NO, HC, and CO). All of the engines were new engines. In addition, two tests were performed to determine the effect of installing the sample probe in different locations. One test was conducted to determine the effects of various air/fuel ratio settings on an engine at take-off power. Author (GRA)

N72-19970# City Coll. Research Foundation, New York.
COMPLEX MIXING MODELS FOR CHEMICAL REACTION SYSTEMS Final Report
Reuel Shinnar and Stanley Katz Dec. 1971 144 p refs
(Grant AF-AFOSR-921-67; AF Proj. 19711)
(AD-734762; AFOSR-71-3003TR) Avail: NTIS CSCL 21/2

A difficult problem that faces the design of any combustion equipment is the fact that the flows are turbulent and often complex and defy a complete analytical description. Mixing processes are very important in any fast reaction and often they are the dominant factor. The investigation encompasses research to evaluate the possible effect of the stochastic and non-uniform nature of the transport processes on nonisothermal nonlinear reactions. New approaches to the evaluation of the magnitude of these interactions are made, and phenomenological models for turbulent flows are proposed, and related to real flows by tracer experiments. The use of tracer experiments in the design and

study by turbulent combustion reactors is discussed and a theoretical framework for the evaluation of tracer experiments in fluctuating quasi-steady flow systems is presented. The advantages of using reacting tracers in reactor modeling is discussed. Design criteria for stirred combustors are given and the effects of imperfect mixing and fluctuating inputs on such reactors is described. Design and modeling of fluidized bed reactors is also treated. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-19971 National Lending Library for Science and Technology, Boston Spa (England).
SEMANTICS AND SCIENTIFIC INFORMATION (SEMANTIC ASPECTS OF INFORMATION)
G. E. Vleduts, V. A. Uspenskii, and Yu. A. Shreider Jan. 1972 27 p refs Transl. into ENGLISH of the publ. "Sematika i Nauchnaya Informatsiya (Semanticheskie Aspekty Informatiki)" Moscow, VINITI, 1970 p 1-45
(NLL-RTS-6815) Avail: Natl. Lending Library, Boston Spa, EngL.: £2.60 or 9 NLL photocopy coupons

Texts as a combination of symbols are used to study semantics. The significance and basic directions of semantic research for informatics are discussed, along with immediate and long term research. J.A.M.

N72-19972*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INFORMATION MANAGEMENT SYSTEM STUDY RESULTS. VOLUME 1: IMS STUDY RESULTS
Nov. 1971 515 p
(Contract NAS8-25140)
(NASA-CR-123547; MDC-G2584-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 05B

The information management system (IMS) special emphasis task was performed as an adjunct to the modular space station study, with the objective of providing extended depth of analysis and design in selected key areas of the information management system. Specific objectives included: (1) in-depth studies of IMS requirements and design approaches; (2) design and fabricate breadboard hardware for demonstration and verification of design concepts; (3) provide a technological base to identify potential design problems and influence long range planning (4) develop hardware and techniques to permit long duration, low cost, manned space operations; (5) support SR&T areas where techniques or equipment are considered inadequate; and (6) permit an overall understanding of the IMS as an integrated component of the space station. Author

N72-19973*# Northrop Services, Inc., Huntsville, Ala.
INFORMATION RETRIEVAL FOR NONSTATIONARY DATA RECORDS Final Report
M. Y. Su Dec. 1971 40 p refs
(Contract NAS8-26757)
(NASA-CR-123550; TR-220-1048) Avail: NTIS

A review and a critical discussion are made on the existing methods for analysis of nonstationary time series, and a new algorithm for splitting nonstationary time series, is applied to the analysis of sunspot data. Author

N72-19974*# Clingman (W. H.) and Co., Dallas, Tex.
A CONTINUING PROGRAM FOR TECHNOLOGY TRANSFER TO THE APPAREL INDUSTRY Final Report, 1 Feb. - 31 Jul. 1971
William H. Clingman 31 Aug. 1971 81 p refs Prepared for Informatics TISCO, Inc., Coll. Park, Md.
(Contract NASw-1812)
(NASA-CR-125681) Avail: NTIS

A six month program has been carried out to investigate various mechanisms for transferring technology to industry. This program has focused on transfer to the apparel industry through the Apparel Research Foundation. The procedure was to analyze the problem, obtain potentially relevant aerospace technology, and then transfer this technology to the industry organization. This was done in a specific case. Technology was identified relevant to stitchless joining, and this technology was transferred to the Apparel Research Foundation. The feasibility and ground rules for carrying out such activities on a broader scale were established. A specific objective was to transfer new technology from the industry organization to the industry itself. This required the establishment of an application engineering program. Another transfer mechanism tested was publication of solutions to industry problems in a format familiar to the industry. This is to be distinguished from circulating descriptions of new technology. Focus is on the industry problem and the manager is given a formula for solving it that he can follow. It was concluded that this mechanism can complement the problem statement approach to technology transfer. It is useful in achieving transfer when a large amount of application engineering is not necessary. A wide audience is immediately exposed to the technology. On the other hand, the major manufacturing problems which require a sophisticated technical solution integrating many innovations are less likely to be helped. Author

N72-19975# Federal Aviation Administration, Washington, D.C. Office of Aviation Economics.
WASHINGTON NATIONAL AND DULLES INTERNATIONAL AIRPORT FORECASTS, FISCAL YEARS 1972 - 1983
Nov. 1971 48 p
Avail: NTIS

Forecasts are presented for eight major traffic categories at Dulles International and Washington National Airports. Categories included are passengers (air carrier and general aviation); cargo (express, freight and mail); and aircraft operations (air carrier, general aviation and military). The report contains actual figures in each of these eight categories for the last six years (1966 through 1971). The forecasts were prepared to meet the planning needs of the Federal Aviation Administration and the Department of Transportation. Expected aviation demand for the Washington Metropolitan Area is indicated. The forecasts provide guidance to airport engineers, regional airport planning officials, and policy makers with which they can develop their specialized studies and recommendations on how this demand can best be met. Author

N72-19976# Federal Aviation Administration, Washington, D.C.
NOTES ON AIR/RAIL PASSENGER TRAFFIC IN THE WASHINGTON, D. C.-NEW YORK MARKET (CALENDAR YEARS 1969, 1970, AND 1971)
Jan. 1972 16 p
Avail: NTIS

The developments in the Washington-New York/Newark passenger services are analyzed. Tables show in detail the month-by-month traffic figures and the trends they represent. METRO, inaugrated in January 1969 with one train daily in each direction, has increased to a current level of 12 in each direction. The combined air-rail through passenger market between Washington-New York/Newark represents $60-$65 million annualy. Round trip fares are $26 million by conventional train, $34 million by metroliner, and $52 million by air shuttle. F.O.S.

N72-19977*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF A DOCUMENT/REPORTING SYSTEM
Bernard Narrow Dec. 1971 46 p
(NASA-TM-X-65842; X-564-71-511) Avail: NTIS CSCL 05B

An in-depth analysis of the information system within the

Data Processing Branch is presented. Quantitative measures are used to evaluate the efficiency and effectiveness of the information system. It is believed that this is the first documented study which utilizes quantitative measures for full scale system analysis. The quantitative measures and techniques for collecting and qualifying the basic data, as described, are applicable to any information system. Therefore this report is considered to be of interest to any persons concerned with the management design, analysis or evaluation of information systems. Author

N72-19978# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
LIST OF DLR RESEARCH REPORTS AND TECHNICAL NOTES, APRIL 1964 - DECEMBER 1970
W. Birkholz 1970 119 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-70-31) Avail: NTIS

An index of reports and technical notes published by German research facilities is presented. The document contains titles and authors for aeronautical and space subject documents published between April 1964 to December 1970. PNF

N72-19979*# Neoterics, Inc., Cleveland, Ohio.
A SYSTEM OVERVIEW OF THE AEROSPACE SAFETY RESEARCH AND DATA INSTITUTE DATA MANAGEMENT PROGRAMS
Washington NASA Mar. 1972 63 p
(Contracts NAS3-13341; NAS3-14979)
(NASA-CR-1976; NEO-2040-711) Avail: NTIS CSCL 05B

The NASA Aerospace Safety Information System, is an interactive, generalized data base management system. The on-line retrieval aspects provide for operating from a variety of terminals (or in batch mode). NASIS retrieval enables the user to expand and display (review) the terms of index (cross reference) files, select desired index terms, combine sets of documents corresponding to selected terms and display the resulting records. It also allows the user to print (record) this information on a high speed printer if desired. NASIS also provides the ability to store the strategy of any given session the user has executed. It has a searching and publication ability through generalized linear search and report generating modules which may be performed interactively or in a batch mode. The user may specify formats for the terminal from which he is operating. The system features an interactive user's guide which expains the various commands available and how to use them as well as explanations for all system messages. This explain capability may be extended, without program changes, to include descriptions of the various files in use. Coupled with the ability of NASIS to run in an MTT (multi-terminal task) mode is its automatic accumulation of statistics on each user of the system as well as each file.
Author

N72-19980# National Science Foundation, Washington, D.C.
[NATIONAL SCIENCE FOUNDATION GRANTS, CONTRACTS, AND EDUCATIONAL SUPPORT]
1972 229 p
(NSF-72-2) Avail: SOD $2.50

Research project support, basic research support for science and computing activities in education, science department program, specilized research facilities and equipment support, and national research centers are listed. National, international, specialized research, and sea grant programs, science information services, and science education support are also tabulated as receiving grants and awards for 1971. J.A.M.

N72-19981*# Library of Congress, Washington, D.C.
SOVIET SCIENTIFIC DISCOVERIES
Russell R. Zavistovich and Andrey Polushkin NASA 1 Feb. 1972 52 p Transl. into ENGLISH from Soviet patent journal Otkrytiya, Izobret., Prom. Obratsy i Tovarnyye
(NASA Order W-131387)
(NASA-TT-F-14252) Avail: NTIS CSCL 05B

An attempt has been made to compile all Soviet discoveries published in various issues of the Soviet Patent Journal since 1957. The report contains brief but all essential elements describing each discovery. One hundred and six discoveries are included. A.L.

N72-19982# Atomic Energy Commission, Washington, D.C.
RESEARCH CONTRACTS IN THE PHYSICAL SCIENCES
1 Jul. 1971 37 p refs
(WASH-1188) Avail: NTIS

The operations of the Physical Research Program are described, and a listing of Federally funded research and development centers is given. Individual summaries are presented of contracts by state, off-site contracts, and new proposals received and actions taken. In addition, separate listings of contracts are given, arranged according to the various fields of research. These fields include: high, medium, and low energy physics; mathematics and computers; chemistry; metallurgy and materials; and controlled thermonuclear research. D.L.G.

N72-19983# Entreprise de Recherches et d'Activities Petrolieres (ELF), Paris (France). Div. Informatique.
SIDERAL: CONVERSATIONAL DOCUMENT RETRIEVAL SYSTEM IN THE TIME SHARING MODE [SIDERAL: SYSTEME D'INTERROGATION DOCUMENTAIRE CONVERSATIONNEL EN TEMPS PARTAGE]
A. Sawa and C. Desporte Oct. 1971 25 p In FRENCH
Avail: NTIS

A computer program was designed by ELF-ERAP, the French national petroleum industry, for computerized information retrieval. The system employs on-line time-sharing on a CDC 3300 computer. Three data bases are used: the API file, the TULSA file, and the company's own file. The different commands available and their operating mode are described. ESRO

N72-19984# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
PRODUCTIVITY OF DEFENSE RDT/E
Charles L. Trozzo Oct. 1971 84 p refs
(Contract DAHC15-67-C-0011; ARPA Proj. T-83)
(AD-734386; P-825; IDA/HQ-71-13644) Avail: NTIS HC $4.75/MF $0.95 CSCL 05/1

The feasibility of measuring the productivity of the military research, development, test and evaluation (RDT AND E) program is investigated. Systematic relationships between the aggregate resources and products of the portions of the RDT and E concerned with the development of new aircraft and missiles are formulated. These relationships trace the aggregate effects of different levels of these portions of the program and consequently measure the productivity of the related RDT and E resources. The relationships can be useful for showing the effects of RDT and E resources as instruments for achieving military security in a way that might be compared to the resources allocated to other instruments such as force procurement, force deployment, and intelligence. Author

N72-19985# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOVIET COMMENTATORS DISCUSS US INTELLIGENCE GATHERING TECHNIQUES
B. Aleksandrov and A. Yurev 3 Nov. 1971 12 p Transl. into ENGLISH from Novoye Russkoye Slovo, 1971 p 1
(Contract F33615-71-C-0142)
(AD-734354; FTD-HT-23-1510-71) Avail: NTIS CSCL 15/4

The authors, using materials from the Western press briefly describe a number of U. S. intelligence-gathering satellites and their missions, in the period from 1960 to the present, including Samos, Ferret, Midas, Vela Hotel. Brief mention is also made of a project 949 satellite which is due to be launched in 1974.
Author (GRA)

N72-19986# National Academy of Sciences-National Research Council, Washington, D.C. Committee on Fire Research.
EMPLOYMENT OF AIR OPERATIONS IN THE FIRE SERVICES: PROCEEDING OF A SYMPOSIUM
R. Keith Arnold 1971 148 p refs Symp. held at Argonne, Ill., 9-10 Jun. 1971
(AD-734078) Avail: NTIS CSCL 13/12

Contents: Urban and rural fire fighting (Los Angeles County operations, Chicago fire department operations, forest fire air attacks, helicopter fire fighting in Viet Nam); Aircraft and facilities (Helicopter accessories for fire fighting, Manufacturers specifications and aircraft performance, Helicopter flight restriction and fire service operations, Communications are essential, Operation and safety problems); Strategy and tactics in air attack (Integrating air attack with fire-fighting strategy, Fire-fighting chemicals, Diversified helicopter services, Current techniques employed by USAF helicopters in crash fire operations, Fire intelligence, General summary and development); Helicopter display and flight demonstration by manufacturers. GRA

N72-19987# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 25, NUMBER 11
John G. Foss and Victoria Hewitson 30 Nov. 1971 31 p
(AD-734144) Avail: NTIS CSCL 14/2

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist. Author (GRA)

N72-19988# Stanford Research Inst., Menlo Park, Calif.
OPTIMUM UTILIZATION OF GOVERNMENT AND NON-GOVERNMENT COMMUNICATIONS RESOURCES Final Report
Allen W. Wiegand, Chester A. Hall, Jr., and Robert W. Strunk Oct. 1971 160 p refs
(Contract DAHC20-67-C-0136)
(AD-734855) Avail: NTIS CSCL 15/3

A number of communication resources exist that are applicable to and available for Civil Defense emergencies to augment and substitute for common carrier and other primary communication means. The study describes the resources and comments on their applicability and the constraints on their utilization. A useful technique for providing guidance to local communication directors to assist in optimum use of communication resources is described. Author (GRA)

N72-19989# Arctic Inst. of North America, Washington, D.C.
ARCTIC LOGISTICS SUPPORT TECHNOLOGY Summary Report
H. Bader, D. Tyree, and H. Love Dec. 1971 55 p Symp. held in Hershey, Pa., 1-4 Nov. 1971
(Contract N00014-70-A-0219-0003)
(AD-734646; AINA-TR-1) Avail: NTIS CSCL 15/5

The document is a summary report of a symposium held to identify, examine, and propose better ways of providing support to ARPA's research efforts in the Arctic Basin. ARPA's interests in the Arctic were identified to focus on mobility, undersea operations and information gathering. Important technologies were said to include such things as surface effect vehicles, under-ice acoustics, remote sensing, and cold region construction. It was emphasized that the ARPA arctic research program is an integral part of the total national arctic program. Papers were presented that described both the current state of the art for arctic logistics support technology and projected future development. They were divided into three main subject areas: (1) transportation, (2) life support, and (3) activity support, i.e., meeting special needs of field investigators in performance of their activities. Author (GRA)

N72-19990# Purdue Univ., Lafayette, Ind.
THE PROCUREMENT PROCESS AND PROGRAM COST OUTCOMES: A SYSTEMS APPROACH Ph.D. Thesis. Final Report
Richard Stephen Sapp Jun. 1971 252 p refs Sponsored by Air Force
(AD-734440) Avail: NTIS CSCL 15/5

A systems approach is used to view the process by which the Department of Defense acquires and modifies its major weapon systems. Attention is focused on the program cost outcomes of this procurement process. The research seeks out the causes of why the final cost of a defense program or contract differs from earlier estimates. The evolution of the term cost overrun into cost growth is traced. Systems diagramming is used to develop a model of the procurement process. The model demonstrates the multiplicity of relationships affecting defense programs. Author (GRA)

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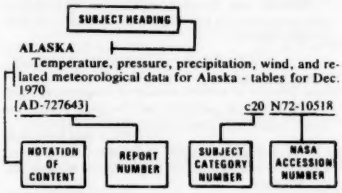

The subject heading is a key to the subject content of the document. The Notation of Content (NOC), rather than the title of the document, is used to provide a more exact description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The subject category number indicates the subject category in the abstract section in which the citation is located. The NASA accession number denotes the number by which the citation is identified within the subject category. The NOC's are arranged under each subject heading in ascending accession number order.

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c02 N72-19141

AIRCRAFT SAFETY
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AIRCRAFT STABILITY
Flight test method for determination of stability and performance characteristics from maneuvers in low and intermediate frequencies
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[NASA-TN-D-6579] c19 N72-19659

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[NASA-TN-D-6656] c01 N72-19001
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[AGARD-R-587-71] c15 N72-19541

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Vortex shredding noise characteristics of isolated airfoils in Reynolds number range applicable to full scale helicopter rotors
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AIRGLOW
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[WRE-TM-498-PT-2] c13 N72-19436

AIRLINE OPERATIONS
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[AD-735132] c21 N72-19722

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[AD-735131] c21 N72-19730

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c02 N72-19031
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[AD-733111] c11 N72-19298

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[JPRS-55352] c08 N72-19241
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[NASA-CR-123550] c34 N72-19973

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c05 N72-19143
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[JPRS-55357] c17 N72-19596
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[CALT-822-39] c17 N72-19601
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[COO-2018-24] c17 N72-19602
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[LBL-163] c17 N72-19604
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[AD-734426] c17 N72-19621

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c02 N72-19016
Design, development, and characteristics of light weight radar altimeter and driftmeter for installation on landing planetary probes
[NASA-TM-X-65837] c14 N72-19517

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Anodic oxidation method for corrosion protection of aluminum
[AD-734864] c18 N72-19651
Effects of ion bombardment on optical properties of electrolytic copper, pure aluminum, and titanium alloy
[NASA-TM-X-67660] c23 N72-19734
Upper-limit charge exchange cross sections for mercury ion on molybdenum atom and cesium ion on aluminum atom
[NASA-TM-X-2527] c28 N72-19843

ALUMINUM ALLOYS
Gas dynamics in plasma arc welding of metals and alloys
[AD-734054] c15 N72-19554
Research and development in metals joining including aluminum alloy bonds and nickel alloy bonds
[AD-734213] c15 N72-19558
Brazing of steels and aluminum alloys by vacuum brazing, vacuum heating, gas quenching process
[AD-734923] c15 N72-19567
Development of procedure for extracting aluminum from aluminum-silicon alloys using electrolysis of aluminum silicate ores
[BM-RI-7603] c17 N72-19594
Ductile fracture initiated at small inclusions noting aluminum alloy surface fracture
[NLR-TR-71021-U] c17 N72-19605
Application of constitutional supercooling theory for binary alloy to conditions for ternary alloy solidification
[AD-734010] c17 N72-19607
Stress corrosion behavior of thick sections of high strength aluminum alloy
[AD-734129] c17 N72-19617
Obtaining high strain rate data for aluminum and titanium alloys in torsion using split Hopkinson bar
[AD-734242] c17 N72-19618

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[AD-734990] c17 N72-19620
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[AD-734712] c17 N72-19623
Microstructure and fatigue behavior of high strength KO-1, aluminum alloy castings
[AD-734768] c17 N72-19627
Research projects in metallurgy to determine corrosion and compatibility properties of various alloys
[AD-734938] c17 N72-19628
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[NLL-M-20947-[5828.4F]] c24 N72-19757
Yield point load of aluminum alloy strips with holes
[AD-733813] c32 N72-19925
Inductive sensing of early fatigue damage in 6061 T-6 aluminum
[AD-734342] c32 N72-19927
Random sequence fatigue tests of aluminum alloy box beams in unidirectional bending
[AD-734393] c32 N72-19932

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Aluminum-chlorine formation cells utilizing molten mixtures of AlCl3 and NaCl as electrolyte analyzed for use as high energy density batteries
[AD-734714] c06 N72-19193

ALUMINUM COMPOUNDS
Electrical conductivity and switching properties in glass and glass-aluminum composites
[AD-734252] c26 N72-19823

ALUMINUM OXIDES
Electrical properties and defect chemistry of aluminum oxide at high temperatures
[AD-734149] c26 N72-19822

ALUMINUM SILICATES
Development of procedure for extracting aluminum from aluminum-silicon alloys using electrolysis of aluminum silicate ores
[BM-RI-7603] c17 N72-19594

AMBIGUITY
Annotated bibliography of selected works on ambiguity and its effect on decision making
[AD-734348] c04 N72-19109

AMIDES
Rheological properties of PVC spinning solutions in DMF at low temperature
[RAE-LIB-TRANS-1592] c06 N72-19188

AMORPHOUS MATERIALS
Resonance scattering by spin fluctuations in amorphous alloys
[CALT-822-39] c17 N72-19601

AMPLITUDES
Integral equations resulting from angle dispersion for multipole amplitudes of pion photoproduction on nucleons solved for resonant multipoles
[NOTA-INTERNA-324] c24 N72-19769

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Electronic controlled mechanical recorder for rapid dynamic processes
c07 N72-19203

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Ground station data reduction equipment for airborne analog and digital magnetic tape data acquisition system
[ARL/ME-130] c08 N72-19238

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Dynamic characteristics and operation of pulse height analyzer used in high energy cosmic ray experiments on high altitude balloon flights
[NASA-TM-X-65836] c29 N72-19861

ANATOMY
Space flight stress effects on human vascular system anatomy
c04 N72-19075

ANESTHESIA
Visual evoked potential changes of chloralose anesthetized cats in hyperbaric atmospheres
[AD-733416] c04 N72-19112

ANGLE OF ATTACK
Integration method to derive angle of pitch, flight-path angle, and angle of attack from measurements in nonsteady flight
[VTH-156] c01 N72-19008
Equations for angles of attack and sideslip relative to rolling and nonrolling axis system
[NASA-TM-X-2514] c21 N72-19721
Wind tunnel stability and control tests of delta wing space shuttle booster high and low angle of attack configurations
[NASA-CR-120028] c31 N72-19899

ANGULAR DISTRIBUTION
Angular distribution of solar radiation intensity in cloudy atmosphere
c13 N72-19414
Angular distribution of decay products of electron-positron collisions
[NOTA-INTERNA-327] c24 N72-19770

ANGULAR VELOCITY
Slender wings in roll noting dependence of rolling moment and roll damping on angular velocity and angle of attack
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Morphological effects of gravitational forces on animal microcirculatory system
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Lead, cadmium, and sulfur dioxide contamination of vegetation and affected animals
c04 N72-19387
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Principal axis coordinate system applied to diffraction of electromagnetic radiation by weak sonic vibrations in anisotropic medium
[AD-734753] c07 N72-19233
Development of failure theory for brittle anisotropic materials based on products of coordinate invariant quantities
[SC-DR-71-0764] c17 N72-19599

ANNIHILATION REACTIONS
Annihilation pressure triggering of galaxy formation and gamma ray background observations
[NASA-TM-X-65841] c30 N72-19874

ANNULAR FLOW
Generalized theory for predicting reattachment conditions of incompressible annular jet
[A-21] c12 N72-19309
Quasi-bidimensional models for solving reattachment problems of annular jet
[A-20] c12 N72-19310

ANODIC COATINGS
Anodic oxidation method for corrosion protection of aluminum
[AD-734864] c18 N72-19651

ANTARCTIC REGIONS
Electromagnetic sounding of ice thickness in Antarctica
c13 N72-19407

ANTENNA ARRAYS
Radiation patterns from adaptive loop antenna arrays for aircraft communication systems
[AD-735096] c07 N72-19230
Solid state physics, radio transmission, antenna arrays, control theory, plasma medium, and ferromagnetism
[AD-733971] c26 N72-19821

ANTENNA DESIGN
Mathematical solution for radiation and input impedance problems of ferrite antenna
[AD-734883] c07 N72-19225
Development, characteristics, and evaluation of transmitting and receiving antenna for German satellite tracking ground station
[DLR-MITT-71-10] c11 N72-19297

ANTENNA FEEDS
Modifications to antenna feed systems at three ground stations
[NASA-CR-122365] c07 N72-19207

ANTENNA RADIATION PATTERNS
Directivity characteristics and radiation field of conical double-spiral antenna
[JPRS-55394] c07 N72-19208
Polarization characteristics of frequency stabilized VLF signals measured by loop antenna located on building roof noting radiation patterns
[KGO-716] c07 N72-19211
Properties of antennas for radio communication, broadcasting, and television
[AD-734224] c07 N72-19217
Mathematical solution for radiation and input impedance problems of ferrite antenna
[AD-734883] c07 N72-19225
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[AD-735096] c07 N72-19230
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c07 N72-19507
Facilities and techniques for measuring antenna radiation patterns of spacecraft telemetry and telecommand antennas
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Properties of antennas for radio communication, broadcasting, and television
[AD-734224] c07 N72-19217
Optimal estimator controller technique for antenna tracking systems
[NASA-CR-122366] c08 N72-19239

ANTHROPOMETRY
Anthropometry of flying personnel in Royal Swedish Air Force for application in design of cockpits and aircraft equipment
[RAE-LIB-TRANS-1502] c04 N72-19097

ANTIFERROMAGNETISM
Low field dependence of magnetic permeability maximum in antiferromagnetic hydrated manganese chloride crystals near Neel temperature
[NOTA-INTERNA-330] c23 N72-19744

ANTIGRAVITY
Negative g strap for restraint, and performance during aircraft acrobatics, vibration, and crash impact
c05 N72-19158

ANTIOXIDANTS
Differential thermal analysis and thermogravimetry for estimating polymer antioxidant efficiency
[AD-734226] c18 N72-19641

ANTIRADAR COATINGS
Antiradar camouflage techniques for ICBM warheads
[AD-733507] c31 N72-19913

APOLLO PROJECT
Reentry thermal analysis of Apollo lunar radioisotopic heater for random tumbling and spinning motion
[SC-RR-71-0533] c22 N72-19733
Description of Apollo communication system engineering for space communication and compatibility of unified S band system
[NASA-TN-D-6723] c31 N72-19903
Electronic systems test program for spacecraft/Manned Space Flight Network communications system
[NASA-TN-D-6720] c31 N72-19904
Computerized system for acceptance checkout of Apollo spacecraft equipment
[NASA-TN-D-6736] c31 N72-19905
Window designs and materials for eliminating contamination of spacecraft command module windows - Apollo Project
[NASA-TN-D-6721] c31 N72-19907

APOLLO SPACECRAFT
Design philosophy and development history of Apollo command and service module environmental control system
[NASA-TN-D-6718] c31 N72-19902
Analyses to determine structural loads caused by maneuvers of docked Apollo command and service module/lunar module
[NASA-TN-D-6719] c31 N72-19906

APOLLO 14 FLIGHT
Determination of acceleration levels on heat flow and convection demonstration and Apollo 14 flight data results
[NASA-TM-X-64644] c33 N72-19961

APOLLO 16 FLIGHT
Guidebook to Apollo 16 mission to Descartes region of the moon
[NASA-EP-95] c30 N72-19879

APPROACH
Flight tests of low lift to drag ratio approach and landing using CV 990 aircraft with similar size and performance characteristics of proposed space shuttle vehicle
[NASA-TN-D-6732] c02 N72-19022

APPROPRIATIONS
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[NSF-72-2] c34 N72-19980

APPROXIMATION
Approximation of signum function by odd polynomial of order 2n-1
[NASA-TN-D-6688] c19 N72-19662
Approximation theory and differential equations for solving satellite motion and related geodesy problems
[AD-734023] c30 N72-19886

ARC DISCHARGES
Excitation mechanism of hollow cathode argon discharge column and line intensities in argon spectra
c24 N72-19761
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c24 N72-19764
Analyses of excitation mechanism in argon spectral lines as function of distance in hollow cathode magnetically confined arc discharge
c24 N72-19765

ARCTIC OCEAN
Arctic Ocean ice surface profiles obtained by airborne laser profilometer on Birds Eye 5-70 reconnaissance mission
[AD-734157] c13 N72-19462
Definition of technology applicable to support of science and exploration, communication and logistics, and resource exploitation in Arctic Ocean areas
[AD-734683] c13 N72-19466
Photographs and charts of Arctic Ocean ice reconnaissance mission-BIRDS EYE 1971 project
[AD-735115] c13 N72-19473

ARCTIC REGIONS
Sea ice dynamics in Arctic regions
[AD-734175] c13 N72-19452
Mobility, undersea operations, and data gathering on Arctic basin
[AD-734646] c34 N72-19989

ARGON
Photographic Abel inversion for determining argon temperature profiles at atmospheric pressure
[NASA-TN-D-6672] c25 N72-19781

ARGON LASERS
Laser-optical lever system for measuring pitch and yaw of ground-launched rocket
[AD-735106] c16 N72-19587

ARGON PLASMA
Excitation mechanism and line intensities in hollow cathode argon arc discharge
c24 N72-19760

Excitation mechanism of hollow cathode argon discharge column and line intensities in argon spectra
c24 N72-19761
Thermalization of hollow cathode argon arc and atomic transition probabilities in excited argon spectrum
c24 N72-19762
Radial temperature and density profile calculations for argon arc discharge electrons in hollow cathode confinement
c24 N72-19763
Line intensity measurements for determining excitation mechanism and electron energies and densities in argon arc discharge of hollow cathode
c24 N72-19764
Analyses of excitation mechanism in argon spectral lines as function of distance in hollow cathode magnetically confined arc discharge
c24 N72-19765
Characteristics of free jet flow field of argon heated by inductive arc and expanded into low density wind tunnel
[AD-734685] c25 N72-19794

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Meteorological data for Fort Huachuca, Arizona, for Jan. 1971
[AD-729816] c20 N72-19703

ARMED FORCES [UNITED STATES]
Effects of Q forces on injuries during ejection/extraction escape in USAF
c05 N72-19144
USAF training of airborne skills in ground environment
[AD-732611] c05 N72-19179

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c05 N72-19143

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Lead, cadmium, and arsenic concentrations in human scalp hair and environmental sites in Montana
c04 N72-19389

ARTERIES
Hypokinesia and hypodynamia effects on rabbit cardiac arteries
c04 N72-19087

ARTIFICIAL GRAVITY
Development of magnetic artificial gravity test facility for use in wind tunnel tests to simulate separation of external stores from aircraft in flight
[NASA-CR-1955] c01 N72-19000

ARTIFICIAL INTELLIGENCE
Automatic protocol analysis as task for artificial intelligence
[AD-734286] c05 N72-19175
Causality representation for robot task learning
[AD-734140] c08 N72-19254

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Characteristics of attitude control system and onboard computer used with ANS astronomical satellite for ultraviolet and X ray measurements in space
c14 N72-19491
Development of Canopus star sensor for stabilization of X4 technology satellite
c14 N72-19499
Tables of artificial satellites launched from 1957 to 1970 including manned space flight and American military satellites
c31 N72-19911

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Hybrid optimization for attitude control and perturbation equations of motion for space shuttle ascent
[NASA-CR-123561] c30 N72-19868

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[ARC-CP-1179] c12 N72-19331

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c08 N72-19235

ASTRONAUT MANEUVERING EQUIPMENT
Development of unstabilized propulsion devices for astronaut maneuvering in zero gravity - Skylab program
[NASA-TN-D-6674] c05 N72-19169

ASTRONAVIGATION
Characteristics of sensors for spacecraft attitude determination by reference to earth horizon in visible and infrared spectra
c21 N72-19495

ASTRONOMICAL OBSERVATORIES
Astrophysical research, equipment, and astronomical observatories
[COMMUN-19] c30 N72-19884

ASTRONOMICAL PHOTOGRAPHY
Characteristic curves and detective quantum efficiency of four emulsion types used in astronomical electronography
c30 N72-19875

ASTRONOMICAL TELESCOPES
Design and construction of instrument to measure solar oblateness
[AD-734049] c30 N72-19885

ASTROPHYSICS
Astrophysical research, equipment, and astronomical observatories
[COMMUN-19] c30 N72-19884
Polarized light from planetary nebulae, quasars, pulsars, asteroids, and other celestial bodies
[AD-733424] c30 N72-19890

ASYMPTOTIC METHODS
Sound diffraction by semi-infinite plane
[ARC-CP-1192] c23 N72-19742

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c13 N72-19367
Analysis of microwave absorption and estimates of signal fading in dense atmospheres approximating planet Jupiter atmosphere
[NASA-CR-114416] c13 N72-19427
Intracavity gas cell technique for restricting carbon monoxide laser oscillations to lines coincident with transmission bands of atmosphere
[AD-734417] c16 N72-19583

ATMOSPHERIC CHEMISTRY
Chemical and ionic reactions of upper atmospheric gases
[AD-734110] c06 N72-19191

ATMOSPHERIC CIRCULATION
Effects of air movement, atmospheric stability, and temperature inversions on air pollution, Helena Valley, Montana
c20 N72-19392
Precipitation atmospheric cycles for USSR
[NLL-M-22079-[5828.4F]] c20 N72-19674
Parameters of general atmospheric circulation calculated from geopotential field values, and parameter prediction
[NLL-M-22077-[5828.4F]] c20 N72-19676
Manifestations of solar activity in tropospheric circulation
[NLL-M-22080-[5828.4F]] c20 N72-19677
Initally scaled equations for mean transport and vertical diffusion of trace elements for one-dimensional mathematical model of tropical forests
[AD-734929] c20 N72-19715

ATMOSPHERIC COMPOSITION
Unpolluted aerosol size distribution measurements by condensation counter, optical counter, and impactors
c13 N72-19361
Optical radar signature analysis for determining atmospheric aerosol structure and cloud identification
c13 N72-19368
Spectroscopic analysis of sulfuric acid component in stratospheric aerosol using infrared refraction index
c13 N72-19370
Bibliography on atmospheric particulates
[NASA-CR-125857] c13 N72-19380
Characteristics of electronically operated mass spectrometer for satellite applications and analysis of atmospheric data acquisition
c14 N72-19494

ATMOSPHERIC DENSITY
Comparison of linear trends in time series data using regression analysis for application to atmospheric density data derived from rocket measurements
[AD-734331] c13 N72-19446

ATMOSPHERIC DIFFUSION
Upper atmosphere composition, diffusion, winds, airglow, and contaminant release experiments - bibliography
[WRE-TM-498-PT-2] c13 N72-19436
Initally scaled equations for mean transport and vertical diffusion of trace elements for one-dimensional mathematical model of tropical forests
[AD-734929] c20 N72-19715

ATMOSPHERIC ELECTRICITY
Measurement of geomagnetic and geoelectric phenomena at ground stations in Japan during 1970
[REPT-11] c13 N72-19429

ATMOSPHERIC ENTRY
One dimensional approximation of nongray radiative flux and flux divergence in radiating shock layers of blunt reentry body compared with three dimensional analysis
[NASA-CR-1990] c12 N72-19315
Reentry thermal analysis of Apollo lunar radioisotopic heater for random tumbling and spinning motion
[SC-RR-71-0533] c22 N72-19733
Transition reentry corridor at high angles of attack and transition and subsonic aerodynamic characteristics at low angles of attack for Boeing H-32 space shuttle booster
[NASA-CR-120018] c31 N72-19896

ATMOSPHERIC MODELS
Conference on theoretical models and aerosol measurements for developing realistic models of atmospheric aerosols and air pollution particulates
[NCAR-TN/PROC-68] c13 N72-19357
Modified atmospheric model for global aerosol size distribution
c13 N72-19364
Meteorological wind tunnel investigation of boundary layer flow in simulated temperate and tropical forest canopies
[AD-734326] c20 N72-19700
Atmospheric models for short range weather forecasting in tropic region
[AD-734868] c20 N72-19716

ATMOSPHERIC PRESSURE
Analysis of climatological tendencies and pressure change centers in meteorological prediction and origin of dry summer conditions
[NLL-M-22076-[5828.4F]] c20 N72-19678

ATMOSPHERIC TEMPERATURE
Three statistical methods for determining atmospheric temperature for microwave region
c20 N72-19421
Harmonic analysis of Nimbus 2 sensed black body temperatures for Northern and Southern Hemispheres
[AD-734975] c20 N72-19707

ATMOSPHERIC TURBULENCE
Derivation of cross-spectral functions for vertical and longitudinal components of two dimensional gust field
[NASA-CR-2011] c02 N72-19029
Effect of atmospheric turbulence on transport of oxygen molecules during photochemical reaction in upper atmosphere
[AD-734686] c13 N72-19467
Distortion of laser radiation caused by atmospheric turbulence and effect on performance of laser systems
[AD-734798] c16 N72-19584

ATOMIC COLLISIONS
Internal energy transfer mechanisms in Na D line radiation collisions with Na atoms excited by H2, D2, and N2
[NASA-CR-125804] c24 N72-19759
Inelastic collisions of atoms, molecules, and molecular ions studied to determine transition probabilities between vibrational and rotational energy states
[AD-734291] c24 N72-19771

ATOMIC ENERGY LEVELS
Excitation mechanism and line intensities in hollow cathode argon arc discharge
c24 N72-19760
Analyses of excitation mechanism in argon spectral lines as function of distance in hollow cathode magnetically confined arc discharge
c24 N72-19765
X ray induced electron emission measurements to determine energy levels of core electrons in group 2B-6A semiconductor compounds
[AD-734241] c26 N72-19826

ATOMIC EXCITATIONS
Internal energy transfer mechanisms in Na D line radiation collisions with Na atoms excited by H2, D2, and N2
[NASA-CR-125804] c24 N72-19759

ATROPHY
Hypokinesia effects on rat skeletal muscles
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Atrophy and cytochemical changes in rat skeletal muscles caused by hypokinesia
c04 N72-19086
Atrophy of rabbit leg muscles caused by prolonged hypodynamia and hypokinesia
c04 N72-19090

ATTENUATION
Determination of distortion due to mode conversion, based on attenuation and contour distortion of PCM signal
[NLL-TRANS-2817-[9022.81]] c07 N72-19200

ATTITUDE CONTROL
Optimal control and application to design of attitude control systems for complex aerospace vehicles
[NASA-CR-123560] c30 N72-19867
Hybrid optimization for attitude control and perturbation equations of motion for space shuttle ascent
[NASA-CR-123561] c30 N72-19868

AUGER EFFECT
Auger emission spectroscopy of metallic transfer between polycrystalline metals in sliding contact
[NASA-TN-D-6716] c17 N72-19597

AUGMENTATION
Computer aids to augmenting human intellectual capability
[NASA-CR-1827] c08 N72-19242

AURORAL SPECTROSCOPY
Layout of new spectrograph for polar aurora spectrophotography
[ESRO-SM-82] c14 N72-19525

AUTOMATA THEORY
Control theory, process control, game theory, and automata theory
[AD-734799] c19 N72-19670

AUTOMATIC CONTROL
Formation scheme for automatic control of information resources and document display system for managerial personnel
c05 N72-19167
Automatic control, mathematical models, and computer design and construction
[JPRS-55352] c08 N72-19241

Automatic electric circuit control, and design of optimal and quasi-optimal systems of automatic control
[JPRS-55252] c10 N72-19281
Theorems for simple testor for classifying objects for electric circuit control
c10 N72-19282
Design of optimal and quasi-optimal systems of automatic control using Sylvester form of matrix
c10 N72-19283

AUTOMATIC TEST EQUIPMENT
Automatic histocompatibility testing of cells
[NASA-CR-125590] c04 N72-19071

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Airbag and seat belt analysis as restraints in serious injury European car collisions
c05 N72-19130
Structural crashworthiness performance of conventional automobiles and performance of structural devices designed for protection
c05 N72-19142
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c11 N72-19152

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c11 N72-19153

AUTONOMIC NERVOUS SYSTEM
Gravitational stress effects on neurons in automous nervous ganglia of cats
c04 N72-19077

AUTOROTATION
Articulated autorotor decelerator for retarding and stabilizing air delivered stores
[AD-734309] c02 N72-19041

AUXILIARY POWER SOURCES
Preliminary design summary for space shuttle auxiliary power unit using hydrogen-oxygen propellants
[NASA-CR-1993] c03 N72-19058

AVALANCHE DIODES
Direct current and small signal analysis for avalanche diode design
[AD-734816] c09 N72-19272
Generation of superhigh frequency power using negative impedance characteristics of avalanche diodes in reflection amplifiers
c07 N72-19511
Extending useful frequency spectrum from microwave frequencies to optical frequencies
[AD-734439] c16 N72-19582

AVIONICS
Relating avionics maintenance to aviation safety
c02 N72-19015
Proceedings of conference on avionics in spacecraft covering component technology, instrumentation, satellite subsystems, and satellite systems
[AGARD-CP-87-71] c14 N72-19483

AXIAL FLOW TURBINES
Secondary flow loss analysis on axial flow turbomachines
[AD-734983] c12 N72-19339

AXISYMMETRIC BODIES
Hypersonic wind tunnel measurements of heat transfer over surfaces of axisymmetric bodies at Mach 7.0 using infrared equipment
[DLR-MITT-71-19] c12 N72-19319
Magnetic coil construction and mathematical models for axisymmetric coils
[FOA-2-B-2031-E1] c23 N72-19738

B

BACKGROUND RADIATION
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[AD-734309] c02 N72-19041
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[AD-734993] c32 N72-19933

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[ARC-CP-1189] c01 N72-19006
Vortex breakdown studied by flow visualization noting pressure gradient effect and analogy with boundary layer separation and wake bursting
[ONERA-NT-175] c12 N72-19328
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[NASA-CR-120028] c31 N72-19899
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[AD-734229] c01 N72-19011

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[AD-734793] c24 N72-19773

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[NLL-TRANS-746-1110-[9022.401]] c17 N72-19589

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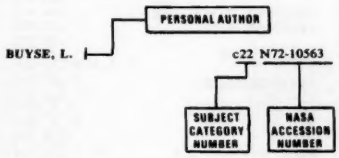

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FLIEGLER, E. c09 N72-19276
FONTANA, R. B. c14 N72-19496
FORTINI, A. c18 N72-19634
FOSS, J. G. c34 N72-19987
FOSTER, B. G. c04 N72-19073
FOUQUART, Y. c13 N72-19414
FRANCHINI, E. c11 N72-19153
FRANKEL, H. c17 N72-19610
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FULLER, G. G. c21 N72-19495
FULTON, F. L. c02 N72-19022
FUNG, A. K. c13 N72-19425
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FUSE, Y. c20 N72-19680

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GERBER, N. c12 N72-19351
GERBER, V. c14 N72-19494
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GRAMPP, E. c04 N72-19100
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HALME, S. J. c07 N72-19209
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HESS, R. c23 N72-19736
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HIRST, D. c07 N72-19514
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HONG, Y. S. c28 N72-19848
HOOVER, M. J. c33 N72-19956
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HUGHES, D. L. c01 N72-18996
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HURST, E. B. c28 N72-19846
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HYDE, E. H. c33 N72-19946
HYOZDETSKII, V. S. c15 N72-19554

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IRANI, B. A. c20 N72-19702
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ISAACSON, L. K. c27 N72-19840
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IVANENKO, N. M. c25 N72-19782

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JAENICKE, R. c13 N72-19361
JAMES, D. J. c07 N72-19514
JANES, G. S. c25 N72-19788
JANETZKE, D. C. c01 N72-18998
JEANFILS, C. c17 N72-19608
JENSEN, D. R. c13 N72-19409
JOHNS, D. J. c32 N72-19924
JOHNSON, A. E. c02 N72-19050
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JOLITZ, G. c21 N72-19719
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JONES, R. K. c05 N72-19134
JONES, W. H., JR. c06 N72-19194
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JONES, W. L., JR. c07 N72-19205
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JOOSEN, W. P. A. c12 N72-19344
JUNGBLUTH, O. c15 N72-19539
JUREWICZ, A. c24 N72-19769
JURKEVICH, I. c30 N72-19876
JURRIEENS, A. A. c13 N72-19401

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KALININ, A. I. LANGENBERG, D. N.
KALMAN, R. E. LANZARA, A.
KANTER, H. LARCHENKO, E. G.
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c19 N72-19666 LARSON, C. R.
KAPLAN, G. S. c26 N72-19812 LARSON, F. R.
KASSEL, S. c26 N72-19815 LASHKO, N. F.
KATINAS, G. S. c26 N72-19835 LASTINGER, J. L.
KATTAMIS, T. Z. c13 N72-19427 LAWSON, J. E.
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KATTAWAR, G. W. c04 N72-19085 LEBEDEV, A. A.
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KATZ, S. c17 N72-19625 LEE, H. K.
KAWATANI, T. c17 N72-19626 LEE, H. R.
KAZARIAN, L. E. c17 N72-19627 LEER, E.
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KELLER, D. V., JR. c13 N72-19461 LEGER, L. J.
KELLEY, M. C. c13 N72-19464 LEGUEN, H.
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KELLHER, W. C. c20 N72-19700 LENOBLE, J.
KELLING, F. H. c04 N72-19104 LENSKAYA, G. N.
KELLY, M. C. c05 N72-19139 LEPPINGTON, F. G.
KELLY, M. W. c15 N72-19549 LEROY, J.
KEMP, R. c13 N72-19469 LESCHACK, L. A.
KENEDI, R. M. c13 N72-19471
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KEREIAKES, J. G. c02 N72-19033 LEVI, I. M.
KESSLER, D. J. c13 N72-19470 LEVINE, J. N.
KESSLER, S. W. c11 N72-19291 LEVINTHAL, E. C.
KHAKHLOVA, N. V. c28 N72-19853 LEWANDOWSKI, B.
KHAUTIEV, E. Y. c04 N72-19140 LEWIS, A. J.
KIBLER, J. F.
KING, E. E.
KING, G. E.
KING, L. A.
KISLIUK, P.
KIVLIGHN, H.
KLEBANOV, V. M.
KLEINHANSS, G.
KLESHCHEV, G. V.
KLESTADT, B.
KLETT, R. D.
KNAPP, S. C.
KNIERIEM, G. R.
KNIGHT, R. J.
KNORR, J. B.
KOCHELAP, V. O.
KOCK, B. M.
KOGAN, Z. N.
KOGELSCHATZ, U.
KOH, J. C. Y.
KOLB, A. C.
KOLESAR, C. E.
KOLSKY, H.
KONONETS, Y. F.
KONSHINA, S. K.
KOONS, H. C.
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KORKEGI, R. H.
KORNILOV, V. A.
KOSINKA, W.
KOSITSKIY, G. I.
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KOZLOVA, W. N.
KRALL, J. J.
KRAMER, L. C.
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KRAUSE, H. F.
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KRAUSS, G.
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KRIEVE, W.
KRINETSKII, E. I.
KROGER, F. A.
KRUGER, G. W.
KRZYWOBLOCKI, M. Z. V.
KUBLAY, D. G.
KUCHTA, B. J.
KUMON, K.
KUPRIYANOV, V. V.
KURTZ, M. K., JR.
KUTZER, A.
KUZMINSKAJA, G. G.
KVAMMEN, G.
KVARTSKHAVA, I. F.

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LAGUNOV, V. M. c11 N72-19293
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LYNCH, P. J. c13 N72-19420

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MERRITT, D. L. c11 N72-19306
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MILLER, C. G., III c12 N72-19324
MILLER, H. c18 N72-19644
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MITTS, L. J. c02 N72-19042
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MONTEGANI, F. J. c28 N72-19845
MONTFORT, F. c14 N72-19525
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MOREAU, R. c16 N72-19513
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MOTT, G. D. c14 N72-19532
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MUSTER, D. c06 N72-19192
MYERS, D. J. c04 N72-19099

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NELSON, I. c13 N72-19441
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NEUGEBAUER, F. c11 N72-19296
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NIKOLAYEV, V. I. c05 N72-19172
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NIVEN JORMA I. c02 N72-19053
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NOBLE, H. V. c26 N72-19484
NOERAGER, J. A. c23 N72-19741
NORTH, J. F. c04 N72-19140
NORTON, R. J. N. c04 N72-19389

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OTT, E. c25 N72-19791
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PAROLI, P. c23 N72-19744
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PAYNE, W. F. c25 N72-19794
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POLAK, E. c10 N72-19280
POLESHUK, M. c09 N72-19265
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PORTNOY, H. c01 N72-19006
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PRYOR, C. N. c07 N72-19221
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RESS, G. c15 N72-19488
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RYAN, R. L. c32 N72-19934

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SAWA, A. c34 N72-19983
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TAYLOR, L. W., JR. c19 N72-19659
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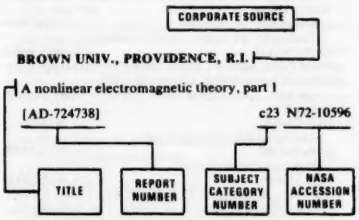

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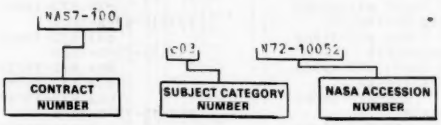

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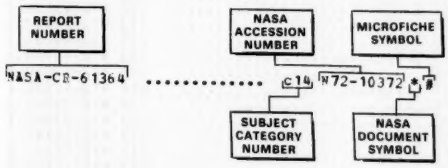

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